FLIGHT

The AIRCRAFT ENGINEER & AIRSHIPS

First Aero Weekly in the World

Founder and Editor: STANLEY SPOONER

A Journal devoted to the Interests, Practice, and Progress of Aerial Locomotion and Transport

OFFICIAL ORGAN OF THE ROYAL AERO CLUB OF THE UNITED KINGDOM

No. 640 (No. 13, Vol. XIII.) MARCH 31, 1921 [Weekly, Price 6d. Post free, 7d.

Flight

The Aircraft Engineer and Airships

Editorial Offices: 36, GREAT QUEEN STREET, KINGSWAY, W.C.2

Telegrams: Truditur, Westcent, London. Telephone: Gerrard 1828

Annual Subscription Rates, Post Free:

United Kingdom .. 30s. 4d. Abroad .. .. 33s. 0d.*

These rates are subject to any alteration found necessary under abnormal conditions and to increases in postage rates

* *European subscriptions must be remitted in British currency*

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April 18–20	Monaco Seaplane Meeting
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May ...	Seaplane Contests on Lake Garde, Italy
May 15 ...	Entries Close for Schneider Cup
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EDITORIAL COMMENT

ONE of the principal factors which have militated against the use of the airship for commercial purposes, so far as this country is concerned, mainly because of our variable weather conditions, is the nature and cost of the housing and mooring facilities hitherto required. Roughly, a shed for the accommodation of one of the largest types of rigid airship may be taken to cost practically as much as the ship herself. Not only is cost almost prohibitive, but there is the added disability that it is a work of considerable difficulty and danger to the ship to attempt to house one of these craft should there happen to be a cross wind blowing. The Germans found this, and tried to overcome the difficulty by building sheds at Heligoland which were capable of being turned in any required direction. Obviously, this is cumbrous and very costly, matters which are of no particular moment in war but which render the big airship uneconomic for commercial use. Our own experience of mooring-out our patrol airships during the War convinced our authorities that it was possible to do without sheds altogether, so far as purely traffic requirements are concerned, using a few such structures simply as docks for construction and repair purposes. It is one thing, however, to moor out craft of the N.S. type and quite another to deal with the big rigid ships. Necessity, as is almost always the case, has led to the development of a means of overcoming all the difficulties. This is the mooring mast, the latest type of which is the one at Pulham, at which R.33 has been riding in perfect safety and comfort since the 2nd of February in winds sometimes blowing with a velocity of from 45 to 50 m.p.h.

The Mooring of Airships

The conclusions which have been reached as a result of the experiments carried out at this station are interesting, particularly in the present indeterminate state of the future of British airships. It has been shown that big airships can be safely brought up to the mast and moored in winds up to 30 m.p.h., and this with the experimental mast and equipment in existence at Pulham. All the experience gained tends to demonstrate that it is now possible to construct

a mast and gear which will enable a ship to land and leave with safety in all winds—which means that airships can be operated with the same certainty that applies to steamships, and that they are, therefore, not so much a commercial possibility as a certainty. It may be agreed that there is more in the proposition than the mere ability to maintain regular services. In order to interest the capitalist who is asked to put his money into airship services, it must be proved that not only is it possible to maintain these services but that they must be able to pay their way, and, further, to show a profit. We believe that the necessary proofs of this are ready to be shown. According to those who should be in a position to speak with reasonable certainty, the present types of rigid airships can be operated between this country and India as mail and passenger carriers to show a fair margin of profit while charging ordinary steamer fares. If this is so, added to the fact that the mooring difficulties have been surmounted and a very heavy capital charge on the enterprise thus eliminated, then there ought to be no reason left for scrapping the ships. We very seriously suggest that, if private enterprise remains shy of taking over these craft—though there seems reason to think that something may happen in this direction shortly—the Government should run an experimental service during the present year at least in order to show what can be done with them. The authorities concerned appear to have no doubt about their commercial possibilities, and, if they are correct, there cannot arise any question on the score of the necessity for economy. On the contrary, if these ships can be run to pay their way, obviously the taxpayer stands to benefit.

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Lord Londonderry and Commercial Flying

In a recent statement to *The Times*, Lord Londonderry has set forth very clearly the aims which have guided the Subsidies Committee in the steps which have already been taken, and has indicated with equal clarity the second stage of the enquiry which is now to be undertaken. The problem, he says, is two-fold. The first and most urgent part of it has been to get British machines again into the air on the Continental routes. That aim, which took precedence of all others, has now happily been accomplished. It is hardly correct, he says, to assume that the firms concerned in the renewed cross-Channel services have been guaranteed against all losses. What the arrangement arrived at really means is that these firms have been placed in a position to reduce their passenger fares between London and Paris to the French standard rate of £6 6*s*. for the single journey and to still have the ability to make profits.

Lord Londonderry expresses the view, to which we agree with certain reservations, that one of the principal stumbling-blocks in the way of transport by aeroplane is a lack of suitable machines for commercial use. Though valuable experience has been gained in experimental commercial flying since the end of the War, and though much of the data is promising, the air transport industry has not hitherto been in a position, financially, to equip itself with those machines which would show the best results.

Quite so, but where lies the fault? It is not with the firms concerned in the industry, who wanted to go right ahead at the end of the War. Certain firms in the industry grew to enormous dimensions during the War and, on paper, made a great deal of money. Had it not been for the system of taxing profits made by such firms, they would all of them have been in a very favourable position to start on the development of commercial work at once. But the demands of the Excess Profits Duty and the munitions levy, added to those of ordinary taxation, left these firms without a feather to fly with, and we know only too well what began to happen to apparently prosperous concerns the moment Government orders for war machines fell off. A Government with prevision and a true appreciation of the vital importance of maintaining the aeroplane industry would have visualised the situation as a whole, and would have made its plans for keeping alive that industry, which its own scheme of taxation had drained of its very life-blood. We have no quarrel with the system pursued of taxing profits made directly out of the War, but we do maintain that the system having resulted in a state such as we have indicated, it was the business of the Government to have devised ways and means of keeping together an industry which everyone is agreed is a vital one commercially and from the standpoint of the national security.

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To Encourage Design

Lord Londonderry lays down that it must be a main purpose to encourage and stimulate the power of British air design. Designers and constructors are, with the experience gained in flying between London and the Continent, in a position to produce machines which are infinitely superior to any types of converted war-craft, and as soon as a sufficient number of such improved machines can be put into service the whole aspect of the question, from the point of view of profitable working, will be completely transformed.

That may be perfectly true, but it must be pointed out that even with these improved machines it is hardly likely that the British capitalist will be so foolish as to risk money in a enterprise which cannot possibly show him a return if it has to be operated in the face of foreign competition, heavily subsidised by the States concerned.

In a word, there can be no private move that matters until there is a Government policy, clear and unequivocal. The mere fact that the cross-Channel services have been resumed under a Government guarantee does not make assured the whole future of the British movement.

The Under-Secretary for Air goes on to say :—

"Now, having accomplished this first stage of our work, we are faced by the very important second stage. This is to convert our purely temporary expedient into something permanent—something worthy of the future development of this great industry. We have to look a long way ahead, and everything we do, as I have said, must bear upon the question of encouraging British air design.

"So far, in our enquiries on the committee, one can certainly say that the general trend has been towards the idea of a national company. But it must, of course, be an organisation that the Government can support with the entire approval of everybody concerned. And this means that we must explore the whole field most carefully. Many suggestions have already been made to us. There are many points, also, which we have to bear constantly in mind. Without attempting to go into details, which at this moment would be injudicious, one may say that the prospects are hopeful. There is every reason now to believe that, after our committee has effected its urgent purpose of re-starting British flying, the enquiry will be carried on until this aircraft industry is established, as it should be, as a healthy, progressive, national enterprise. No effort must, indeed, be spared until that goal is reached."

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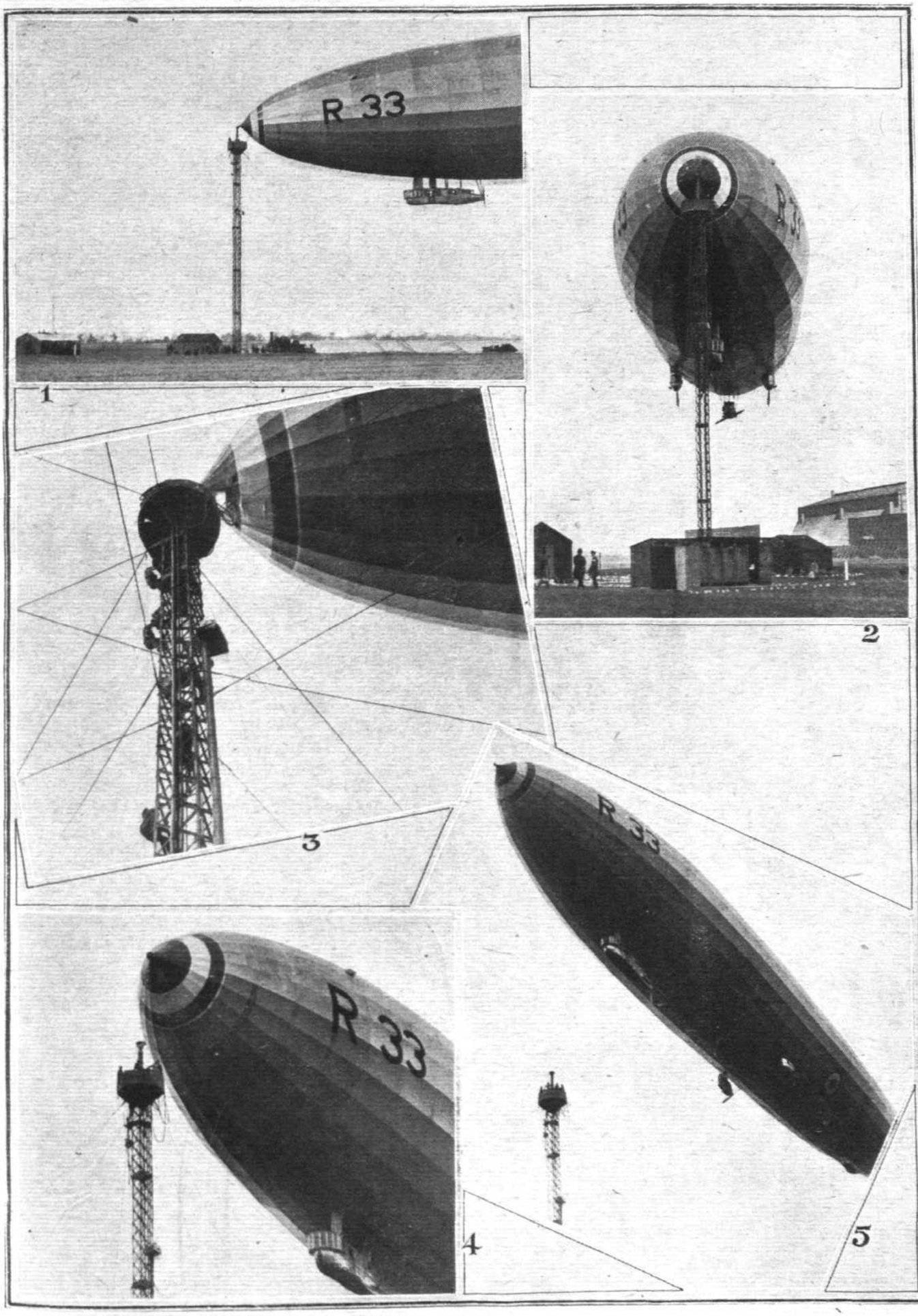
AIRCRAFT ENGINEER AIRSHIP



THE AIRSHIP MOORING MAST AT PULHAM: 1 shows a general view of the mast, with "R. 33" moored to it. 2 is a front view of the airship. 3 the upper portion of the mast, showing crew climbing towards the platform; note the hydrogen pipe running up the side of the mast. 4 shows the airship just free from the mast, and in 5 she is well away.

All this is perfectly sound and seems to travel along the right lines, so it would seem we are really on the eve of developments that will infuse new life into the industry and assist to establish British commercial aviation on a satisfactory and enduring basis. As to that, we can only wait and see.

In the meantime the scheme of the National Company put forward by Mr. Holt Thomas with £1,000,000 guaranteed (without remuneration) should be held in mind. A National Company of this character would be far more acceptable for the future of the British aircraft industry than any bureaucratically hampered concern. Although Mr. Holt Thomas and his friends have been, after making their definite offer, quite willing to stand aside when there was a reasonable chance of the Government rising to its responsibilities, we do not doubt that they would be quite willing to renew their offer and go ahead with their million guarantee for encouragement, should the support to be given by the Government after all turn out to be another Will-o'-the Wisp a-flitting.

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Civil Aviation in the House

During the discussion of the Consolidated Fund Bill on March 22, Sir W. Joynson-Hicks again raised the subject of civil aviation, with particular reference to the scrapping of the airship service. He wanted to know if it would not be possible to set aside, out of the Air Estimates, a sum of from £150,000 to £200,000 for civil aviation during the current year. Regarding the airships, he pleaded that the expenditure of a quarter of a million a year for the next two years would enable the experts to decide conclusively whether or not the airships are going to be useful for military or naval purposes. He pointed out that the Air Ministry proposes to expend no less than £3,250,000 on buildings this year, and asked that the Estimates should be so re-arranged that one-thirteenth of this sum could be allotted to further experimental work with the airships.

Gen. Seely followed with a trenchant criticism of the vacillations of the Government in connection with this particular side of aviation. A year ago, he said, we were told that no one could foresee the value of airships for peace. One thing was certain—that an airship had flown to America, and this one of obsolete type. A vast possibility was there for research at a very modest expenditure. And yet, within a year, we find all the expenditure on the military side going on and civil aviation absolutely at an end and the airships scattered. The British Government had never done a more absurd thing. We banked on one thing in 1919, reasserted it in 1920, and scrapped the whole lot in 1921. That was the way that minor and unimportant States acted, but it was not the way the British Empire had been built up. It was a ridiculous thing to scrap all the intelligence, all the brains, all the effort that had been put into a three years' intensive struggle in order to save money here, while in all probability more would have to be spent in building up the airship service in years to come.

It must be said that Capt. Guest, who replied in the absence of the Air Minister, did not cut a very heroic figure. He based his defence upon the statement that a round £1,000,000 was to be devoted to civil aviation under the current Estimates. That appears to be the sole argument he was able to find in the course of a fairly lengthy speech in defence of the policy of the Air Ministry. It is a matter of common knowledge that such a sum has been allocated to civil aviation. We ourselves have commented upon the fact on more than one occasion. The real trouble is not so much with the sum estimated for as with its allocation.

We cannot, *pace* Capt. Guest, agree that everything is satisfactory when we regard the manner in which this sum is distributed. The basic fact remains that out of a million sterling no more than £60,000 has been specifically allotted to the direct assistance of civil aviation. True, we hear that this is to be increased materially—it has been said that the sum to be thus expended is £250,000—but the point is that the present actual allotment stands at the smaller figure. It does not help much to know that a million of money is to be spent on paying an expensive staff at the Air Ministry and in laying out ground organisation which is useless because there are at present no machines in the air to make use of the landing facilities on which good money is being spent—unless the deliberate intent is to encourage the foreigner to run air lines from the Continent to this country.

We agree the necessity for economy in all public expenditure, but if a million is all the country can justifiably be asked to find at the present juncture, surely it would be better to devote more of it to encouragement in the one direction and less to the payment of staffs to oversee what does not exist. Capt. Guest was at a distinct disadvantage in replying to a question which concerned another Department than his own, but with all that he was singularly unconvincing in his defence of air policy.

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The Proposed Iceland–England–Denmark Air Service

Apropos the air service overseas from Iceland mentioned last week, this is a natural development from the local service in Iceland of Avro machines which were procured last year, and which have done good service in the country, especially for discovering shoals of fish. The air fleet is now being enlarged by several new machines of the Curtiss type, and this summer the Icelandic company proposes, according, to the Danish Press, opening out overseas, going from Reykjavik *via* Leeds in England to Copenhagen and back to Iceland.

Germany Claims Free Aero-Construction after July 10, 1920

THE German Government, it is reported, in reply to a note from the Inter-Allied Aeronautical Control Commission of March 17 asking whether manufacturers of aeronautical material are still supported by the German Government in their continued violation of the Entente's Boulogne decisions, states that it still adheres to its standpoint that the Versailles Treaty does not give the Allies the right to prolong the embargo on the manufacture and importation of aeronautical material beyond July 10, 1920, and proposes that the matter be referred to the arbitration of a neutral Court.

Denmark Proposes an Air Station at Kastrup

A SMALL Advisory Committee has been appointed by the Danish Government to draw up plans for the erection of an air station (aerodrome, airship base and seaplane harbour) at Kastrup on the Island of Amager, near Copenhagon. The Committee consists of the following :—

Chairman, Mr. Knud Gregersen, Ministry of Traffic; Mr. Søren Svendsen, Member of the Rigsdag; Lieut.-Col. Kock, Head of the Danish Military Flying Corps; Commander Grandjean, Head of the Danish Naval Flying Corps; and two engineers, Helwig and Jensen, who are both Government employés.

In order to examine the organisation of aerodromes in Great Britain and France, it is proposed that the committee shall make a tour in these two countries. The head of the committee, Commander Grandjean, is expected to arrive in England shortly to make preliminary arrangements, and the remainder of the committee is expected towards the end of this month. After the committee has presented its suggestions, it is hoped that it will be possible to commence building operations in the Spring of 1922. It is unlikely that steps will be taken to construct an airship base until 1925.

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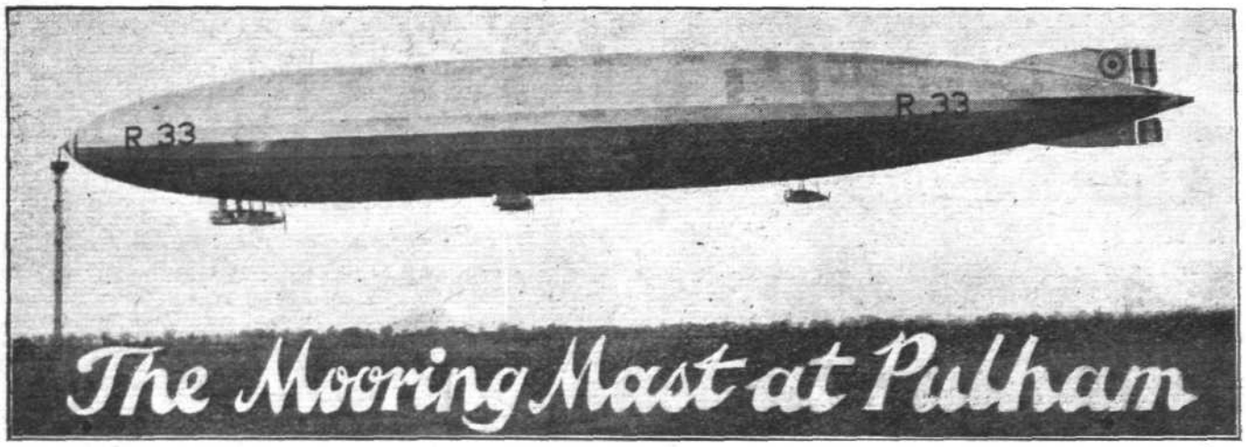
AIRCRAFT ENGINEER AND AIRSHIP



The Mooring Mast at Pulham

IT has repeatedly been stated by airship experts that the future of airships for commercial purposes will be greatly affected by the success or otherwise of the development of the mooring mast. If this invention proves efficient, it will mean that the question of ground organisation will be very greatly simplified. Not only will intermediate airship stations not require large and costly sheds, but, what is perhaps more important still, ground parties will be reduced from a matter of about 300 men to a round dozen. Furthermore, the safety of the airship will be relatively complete. Once in the air, the airship has proved that it is capable of facing practically any conditions that are likely to occur, or if not, it is able to avoid them by going to some other locality where conditions are more favourable. Hitherto the greatest drawback to the use of airships has been the danger of taking them into or bringing them out of their sheds. For this purpose very large parties have been required, and even then it has been necessary to await favourable weather before venturing to tackle the task. If the mooring mast can be developed to such an extent that airships can safely ride out any weather within reason, the airships will only have to go into their sheds for general overhaul, much as ships go into dry dock.

In view of the importance of the mooring mast problem, a few notes on what has been accomplished in this country up to date may not be without interest, and, incidentally, here is one sphere of airship work in which this country has taken the lead. Germany has a start of several years in the matter of airship design and construction, but as regards landing the airships, she has mainly relied on landing crews, assisted by elaborate guide rail arrangements. The question of mooring out airships has been studied for several years in this country, and it may be remembered that already before the War there was in existence at Farnborough a small mooring mast with which experiments were being made. This mast was used for small non-rigid airships, this country having at that time no airship of the rigid type. During the War experiments were continued, both with mooring masts and three-wire moorings, as well as with mooring at sea. Messrs. Vickers, Ltd., carried out experiments at Barrow with a mooring mast for rigid airships, and lately, since the beginning of February of this year, in fact, experiments have been conducted at Pulham Airship Station, Norfolk. On March 23 representatives of the Press had an opportunity of visiting Pulham and seeing there the results of the work that has been carried out. Although there are still problems to be solved, it may be stated that the last two months' experiments have shown conclusively that the problem of airship mooring is capable of a satisfactory solution.

On arrival at Pulham the Press representatives were met by Colonel Pace, who is in charge of the station, ably assisted by his staff, among whom was Major Scott, of " R. 34 " fame, to whom is due a great deal of the credit for the successful results obtained. Major Scott combines to a most extraordinary extent the qualities of a most skilful airship pilot with thorough technical knowledge of the intricate problems of airship construction and design, and to his enthusiasm and genius much of the progress must be ascribed. It is sincerely to be hoped that, now that service airships have been deleted from our programme, the commercial side will be taken up so that the excellent work done by such men as Major Scott, no less than by our airship designers and constructors, may not be wasted, but may bear fruit along more peaceful lines than those on which airship work has hitherto been used.

One could devote a long article to the airship station at Pulham, but for the present space does not allow of doing so, and our remarks must be confined strictly to the details of the mooring mast experiments, leaving the question of the airship station, its equipment and its future, to another time.

The mooring mast at Pulham is a steel lattice girder about 115 ft. high. At its base the mast is mounted on a pin joint, and is braced laterally by cables attached near the top and near the centre of the mast, running to concrete blocks placed on the circumference of a circle of about 250 ft. diameter. These cables are somewhat in the way, and when permanent mooring masts come into use it is highly probable that the cables will be done away with, the mast itself being built so as to withstand lateral loads without external bracing. As the mast is pin-jointed at its base, it will be seen that it acts as a strut in pure compression, the lateral loads being taken by the cables. Inside the mast is a steel ladder running to the platform at the mast head. Above this platform the mast terminates in a long, large-diameter telescopic steel tube, the upper extremity of which is in the form of a hollow disc or cone, so mounted as to be free to swivel. On the nose of the airship, which has been specially strengthened for the purpose, is another cone, the male one, fitting snugly inside the female cone on the mast when the airship is moored. Through the cone on the mast a cable passes down inside the mast, over pulleys and to a winch driven by an ordinary steam tractor. Again, this is a temporary arrangement only, the question of economy having necessitated a good many makeshifts. The permanent mast of the future will doubtless have electrically-operated winches.

About three in the afternoon on the day of the visit to Pulham all was ready for a flight, and the crew climbed to the mast head, some using the ladder inside the mast, others swarming up the outside, using the lattice bars of the mast as steps. Arrived at the mast head, the crew entered the airship through a small trap door in the nose *via* a rope ladder. This looked a somewhat precarious proceeding, and would scarcely appeal to nervous passengers. When, however, airships come to be used for commercial work, the mast will probably be tubular, and passengers will be carried up to the mast head in a lift, and will enter the airship through doors with concertina bellows so that they will not see the ground until they are safely inside the airship.

At the time of the demonstration a strong wind was blowing, the anemometer later showing that at the moment of casting off the velocity of the wind was 40 m.p.h. The engines were set going, with their clutches out so that the propellers were stationary. Just before giving the signal to cast off, the commander of the airship set the rear screws in motion as the wind was blowing directly towards the large sheds, and it would be dangerous to let the airship drift astern. At a signal from the airship the man on the mast head cast off the mooring cable by pulling a lever. The nose of the airship rose above the mast, veered a little to starboard, and the engines were opened out, the airship clearing the mast easily and proceeding on a short trip. While she was away, one watched with interest the preparations for her return, which were very clearly explained by Major Scott. The cable passing through the cone at the mast head was paid out until the end reached the ground outside the mast. It was then secured by a small party of men, who proceeded to haul it out along the ground to leeward of the mast. In this manner about 1,000 ft. of cable were paid out, and the spot where the end of the cable was lying was marked with a flag. In addition to this main cable there are lateral cables placed on the ground, at right angles to the main cables. The purpose of these became clear when, later in the afternoon,

the airship returned to pick up her moorings. This occurred about five o'clock, the airship coming in from the leeward and proceeding slowly until she was over the flag indicating the end of the mast cable lying on the ground. While approaching, the airship had dropped the bight of the cable carried on board, and when low enough, and immediately above the end of the ground cable, the end of the airship's cable was dropped and secured by the landing party to the end of the ground cable. Two more cables were let down from the airship, and the ends of these were secured to the ends of the lateral ground cables. The effect of this arrangement was to stop any lateral surging by the airship as she was being pulled in. Now came the manœuvre which really marked the greatest improvement in mooring to a mast. Hitherto it has been customary to haul in the airship *horizontally* to its mast. At Pulham, however, they have devised a better way, which does away with practically all the stresses. This consists in letting the airship rise until the cables are taut and the ship is approximately vertically above the mast. Then, and not until then, the winch on the ground is set in motion and the airship is pulled in *vertically*.

The telescopic tube at the top of the mast is free to lean over to a certain extent, and can thus follow the slight movements of the airship. The two lateral cables, also attached to the nose of the ship, are pulled in simultaneously until a certain point is reached, marked on the two cables. The two winches operating these cables are then stopped, and the lateral cables then form the two sides of a triangle which has the ground as a base. As the main cable is hauled in, the airship is slightly to leeward, and as she approaches the mast head the two lateral cables pivot on their base, so to speak, their point approaching the mast head and describing an arc with the base of the triangle as a centre. As soon as the cone of the airship touches that on the end of the telescopic arm, the two cones automatically lock, and the airship is virtually moored. The last few feet, which compress the springs in the telescopic tube, are hauled in by the means of a chain tackle, as it is difficult to operate the winch with the steam tractor to such a nicety as to ensure not overwinding and damaging the arm and cones. On the occasion of the visit to Pulham the operation of mooring the ship, from the time of securing the end of the airship's cable to that of the ground cable until made fast was about 40 minutes, but it has been done in 25 minutes under more favourable weather conditions. Compared with the time taken in bringing a liner into dock, this is very quick work, and when tackle of a more permanent and refined nature is available, the time should be shorter still. In the high wind prevailing during the demonstration there was no sign of any stress or sudden jerks being put on the airship, everything working very smoothly and without a hitch. Already it can be safely said that mooring to a mast does not present any difficulties, the airship riding quite serenely even in very bad weather, while getting away and picking up moorings can be done in very high winds.

There are, of course, still problems to be solved: it would be idle to pretend otherwise; but all the main problems have been successfully tackled and the *vertical* hauling in has, perhaps, done more than any other single thing towards attaining this end. There is still the question of snow collecting on the airship, but this problem is also being attacked with, we believe, good prospects of success.

While at anchor at the mast the airship is in the charge of an anchor watch, consisting of a few men, who attend to the trim of the airship as the temperature changes. Water, petrol, and hydrogen are conveyed to the airship through pipes running up the mast, and no difficulty has been experienced in the arrangement of taking on board supplies of this nature. The problem of guarding against the ill effects of false lift caused by the sun is also receiving attention, and, in any case, on a commercial airship service the trips would probably be so arranged that anchoring would take place towards evening, when the air is usually fairly calm and there is no sun to produce false lift. Refuelling could be done during the night, and the airship be ready to leave next morning.

It should be mentioned here that experiments have shown it to be quite feasible to leave the mast and also to arrive at it during the night. Aldis lamps are then used for signalling between the airship and the mast crew. Incidentally these lamps were also used to give the commander of the "R. 33" the temperature at the ground and at the level of the mast head, while white and red flags on board the airship and on the mast head were used for signalling directions while mooring, the white flag indicating "Haul away," while the red flag signified "Stop hauling." The same signalling can be done equally well at night by means of lamps.

It is to be hoped that before long we shall see mooring masts erected in various parts of the country and along the route to India and Australia. It would then only be necessary to have repair sheds at the terminal air stations, the airships riding to mooring masts at the intermediate stopping places. We do not know what would be the cost of erecting such masts, but it could at any rate not be very great, and should be very well worth while, considering the amount of money such masts would save in shed and handling expenses. One thing is certain, if we do not take the matter up in this country other nations will, and there is little doubt that the next few years will see airship service routes come into being which will utilise the mooring masts invented and perfected in this country. It is up to us to see to it that some at any rate of these services are British, carried out by British airships manned by British crews.

THE POLES, AIRCRAFT AND THE WEATHER FORECAST

LAST year a new weather theory and method of weather prediction was put forward by three Norwegian meteorologists from investigations carried out on behalf of aerial transport, and comment upon which was made in *The Times* at the time. Our contemporary states that the sponsors claim that this theory is now ready to be put to practical use.

The theory, briefly, is that our weather depends on the interplay of two steams of air, a cold stream flowing down from all round the Pole, and a warm stream flowing northwards from the tropics. The streams meet along a shifting front surrounding the earth in the temperate zone, and our weather conditions, in the air as well as on the sea and land, are chiefly affected, according to the theory, by the strength of the Polar air-stream.

Professor Bjerknes, of Norway, thinks it would now prove well worth while for a ring of observing stations to be erected, completely circling the Pole, from the repeated observations of which it might be established, indisputably, which are the lines followed by the icy Polar air as it moves southward, and also what courses are followed by the return flows of warm air. Such observations, long desired in the interests of sea navigation, should, in Professor Bjerknes' opinion, be delayed no longer now that we are on the eve of regular trans-ocean flying by airships and aeroplanes. He considers, also, that these Polar stations would, apart from their routine observations, prove a safeguard in North Atlantic flying owing to the fact that urgent news might be wirelessed from them, giving warning of any sudden air movement likely to presage a storm.

It would, however, be a task of great magnitude to obtain the requisite data. Professor Bjerknes himself estimates

that a large number of observing stations, continuously at work, would be necessary in order to ensure that the conclusions arrived at were sufficiently accurate.

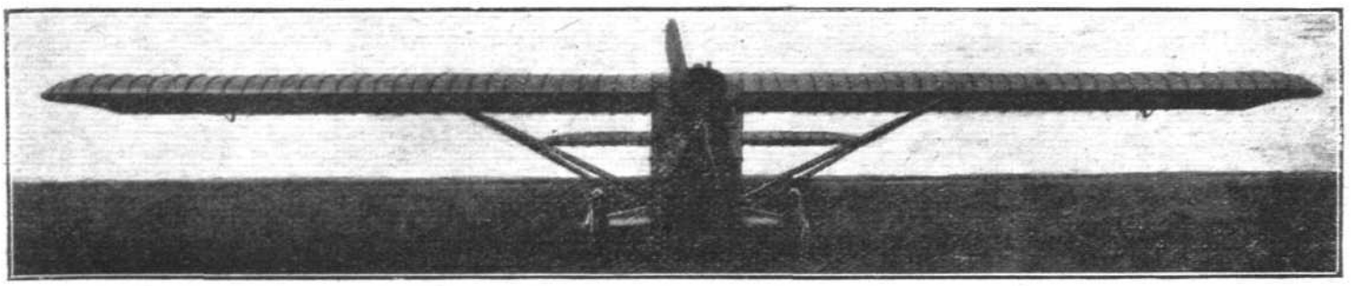
FLIGHT

A NEW GERMAN ALL-METAL MACHINE

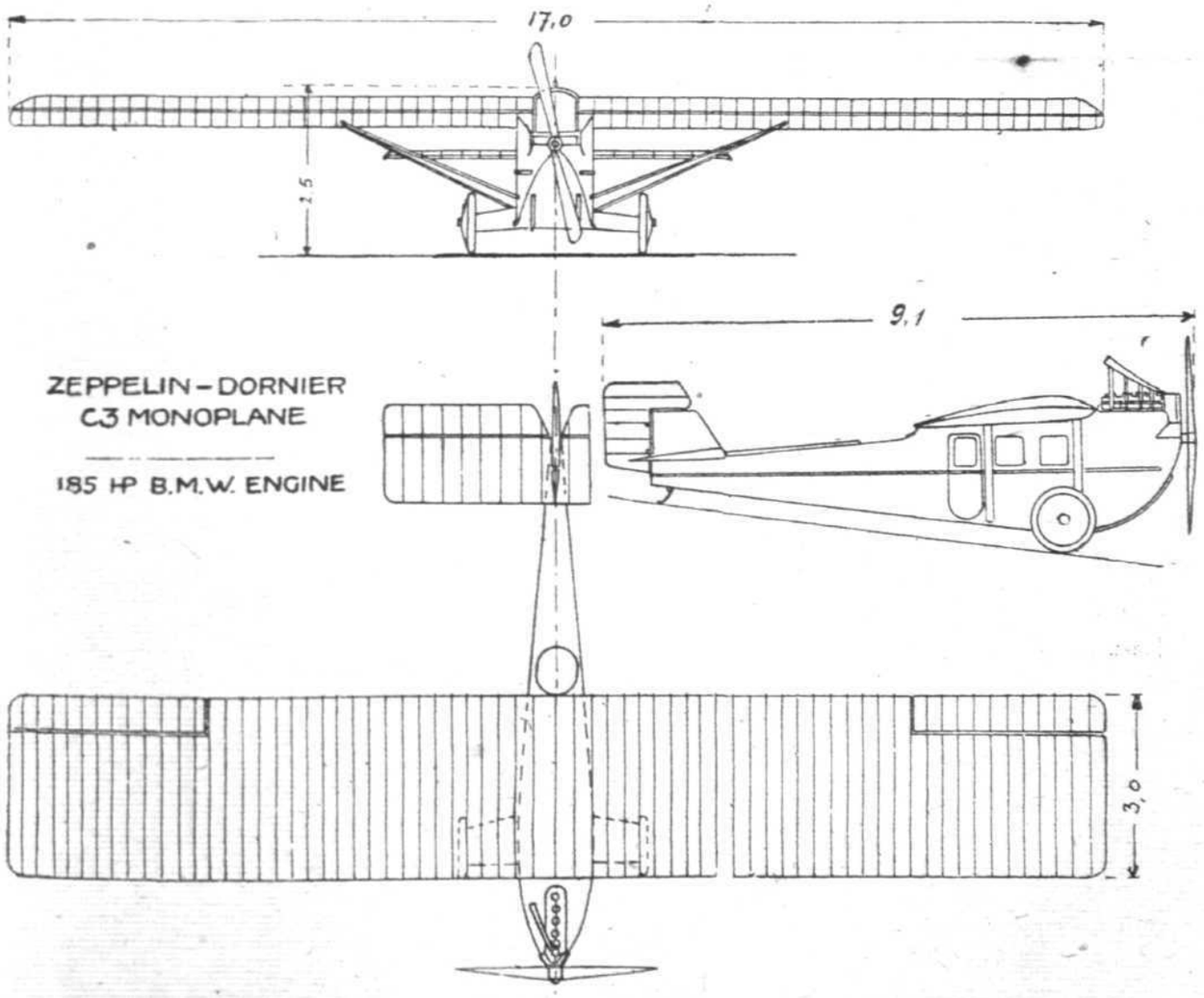
The Dornier C3, 185 B.M.W. Engine

IN our issue of December 16, 1920, we published a description of the Zeppelin Dornier machines built at Lindau. This series of "Milestones" included the latest monoplane flying boat produced at the Zeppelin works at Lindau, and it was mentioned that the products of Herr Claude Dornier, chief designer of the firm, were well worth watching. At the time we also promised to keep our readers informed of any new developments that might come along. An opportunity of keeping this promise has now occurred, the Zeppelin factory having produced a new and highly interesting monoplane to the designs of Herr Dornier. There is, we believe, quite a keen competition going on between the Zeppelin works at Lindau and those at Staaken (the chief designer at the latter factory being Herr Rohrbach) to see who can first produce a really successful commercial machine. The Zeppelin Staaken four-engined monoplane was described and illustrated in our issue of March 17, when we also reproduced the first photograph to be published in this country of a wind channel model of the new twin-engined Staaken monoplane which is now under construction. While Herr Rohrbach seems to devote his attentions to fairly large machines, Herr Dornier at Lindau now appears to specialise more in the smaller, single-engined type, the latest of his productions being the C3 monoplane illustrated herewith. For the illustrations and data relating to this machine we are indebted to the German aviation journal *Illustrierte Flug-Woche*.

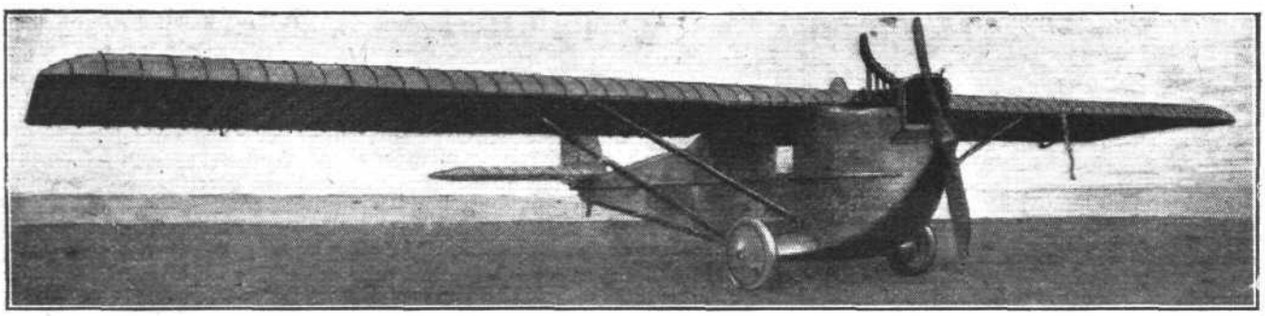
The Do.C3, as the new machine is styled, is an all-metal monoplane with fairly thick wing section. A peculiarity, which the Do.C3 shares with the previous monoplane flying boat, is that, although the wing is of deep section, it is tapered neither in chord nor in depth. The consequence is that it has not, apparently, been found possible to make it a true cantilver wing, it having a pair of struts on each side to support it. Aerodynamically it is an advantage to taper the wing, as a fairly high L/D ratio can then be obtained while still retaining a fairly high maximum lift. Such a tapered wing, how-



THE ZEPPELIN DORNIER C3: Front view.



THE ZEPPELIN DORNIER C3: General arrangement drawings.



THE ZEPPELIN DORNIER C3: Three-quarter front view.

ever, is more expensive to build than is a parallel one, and possibly it is this fact which has influenced Herr Dornier in his choice of wing form.

Constructionally the wing of the Do.C3 is interesting on account of the fact that it is built of metal throughout. The framework of the wing is in steel, while the covering is stated to be sheet Duralumin. Although this covering does undoubtedly strengthen the wing, no account of this has been taken in stressing the machine, and the covering is merely intended to act as a means of maintaining the exact curvature of the wing, it having been found that in high-lift wings quite minute changes in curvature may sometimes have extraordinarily great influence upon the aerodynamic properties. The wing is without dihedral, and is built in one complete unit from tip to tip, the centre of the wing resting on the top of the cabin. Bracing is by means of four streamline section steel tubes, two on each side, running to the lower *longerons* of the *fuselage*. Owing to the considerable depth of the body, the angle of the bracing tubes is very good. Small *ailerons* are fitted near the tips, and the cranks, etc., for operating the *ailerons* are buried inside the wing.

The tail plane is also of approximately rectangular plan form, and is a cantilever structure of similar construction to that of the main plane. The elevator is divided and unbalanced. The rudder, on the other hand, has a balance portion projecting forward above the fixed vertical fin. Tail planes and control surfaces are also covered with aluminium alloy.

The *fuselage* is a steel structure covered with Duralumin, and is very deep in front, the engine being mounted fairly high, and the centre of thrust only slightly below the level of the wing. The cabin is aft of the engine, from which it is separated by a fireproof bulkhead. Seating accommodation is provided for six passengers, who enter the cabin through a door in the starboard side, direct from the ground, without needing any steps, the floor of the *fuselage* being exceptionally low over the ground. Windows are provided in each side of the cabin, and as the wing is above the cabin the passengers obtain an unobstructed view of the ground. It is pointed out that as the machine is intended to a great extent for use over the beautiful scenery of Switzerland, this is a great advantage. Great attention has been paid to the prevention of fire on board, all fuel tanks being situated in the wings, outside the body.

The pilot is placed aft of the cabin, his cockpit being located just aft of the trailing edge of the wing. Here, it is claimed, he obtains a very good view, as he is on a level with the trailing edge, and can thus look over or under the wing at will.

Perhaps one of the most interesting features of the Do.C3 is the undercarriage. This, it will be seen from the accompanying illustrations, is in the form of two short wing roots totally enclosing the wheel axle, with a disc wheel at each end. It would be difficult to imagine a simpler undercarriage, and although the structure is probably fairly heavy, as it almost necessarily must be in order to take the loads from the wheels at the ends of the two short cantilever wing roots, the resistance should be quite small.

The engine fitted to this machine is a 185 h.p. B.M.W. over-dimensioned, high-compression six-cylindered motor, which is one of the best examples of modern German engine design. It is very economical in fuel, even when running throttled, while the effect of the design is to enable the engine to maintain its full power up to a height of about 10,000 ft. The normal power for cruising is 200 h.p. at 1,400 r.p.m., while for short periods, such as for getting off, the engine can be revved up to 1,500 r.p.m., when it develops about 240 h.p. As the machine is fairly lightly loaded per square foot of wing surface, she is said to get off well and to have a good climb, while requiring only a short run for getting off.

The following are the main data relating to the Do.C3 :— Span, 55 ft. 9 ins.; length o.a., 29 ft. 10 ins.; height, 8 ft. 3 ins.; chord, 9 ft. 10 ins.; wing area, 506 sq. ft.; weight, empty, 2,420 lbs.; useful load, 1,600 lbs.; weight, fully loaded, 4,020 lbs.; load per sq. ft., 7.95 lbs.; load per h.p. (on 200 h.p. basis), 20 lbs.; maximum speed, 105 m.p.h.; cruising speed, 80 m.p.h.; ceiling, 16,500 ft.; fuel consumption, .45 lb./h.p./hour; oil consumption, .022 lb./h.p./hour; range, about 400 miles.

THE LONDON-CONTINENTAL SERVICES

FLIGHTS BETWEEN MARCH 13 AND MARCH 24, INCLUSIVE

Route‡	No. of flights*	No. of passengers	No. of flights carrying Mails	No. of flights carrying Goods	No. of journeys completed†	Average flying time	Fastest time made by	Type and No. (in brackets) of Machines Flying
						h. m.		
Croydon-Paris	22	75	8	13	22	2 3	Spad F-CMAY (1h. 54m.) ...	B. (5), G. (3), Sa. (1), Sp. (3), V. (1).
Paris-Croydon	24	94	11	12	22	2 18	Goliath F-FHMU (1h. 52m.)	B. (6), G. (3), Sa. (1), Sp. (3), V. (1).
Cricklewood-Paris ...	5	26	1	3	5	2 57	Airco 9 G-EAUC (2h. 17m.)	A.9 (1), H.P. (3).
Paris-Cricklewood ...	2	15	—	—	2	3 27	H.P G-EATN (3h. 17m.) ...	H.P. (2).
Croydon-Brussels ...	15	5	7	6	14	2 34	Airco 4 O-BARI (1h. 57m.)	A.4 (10), Av. (2).
Brussels-Croydon ...	7	6	7	6	7	2 53	Airco 4 O-BATO (2h. 5m.)...	A.4 (4).
Totals for two weeks...	75	221	34	40	72			

* Not including "private" flights. † Including certain journeys when stops were made *en route*.
‡ Including certain diverted journeys.

A. = Airco 4. A.9 = Airco 9 (etc.). Av. = Avro. B. = Breguet. Br. = Bristol. Bt. = B.A.T. F. = Fokker. Fa. = Farman F.50. G. = Goliath Farman. H.P. = Handley Page. N. = Nieuport. P. = Potez. Sa. = Salmson. Se. = S.E.5. Sp. = Spad. V = Vickers Vimy. W. = Westland.

OIL-PROSPECTING BY SUPERMARINE

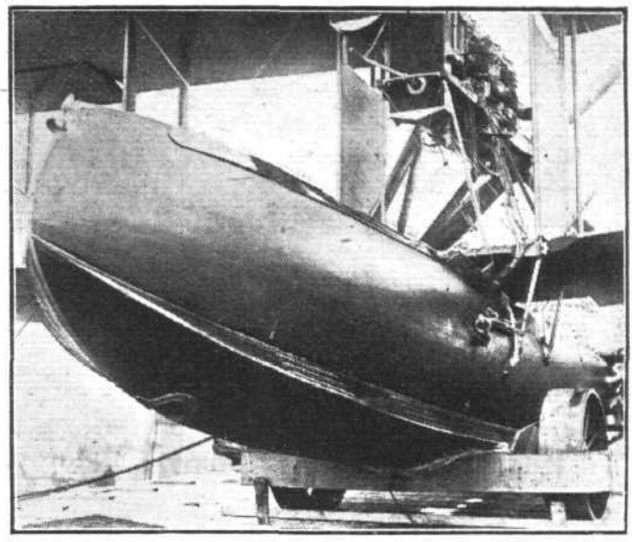
AN interesting experiment is shortly to be carried out by the British Controlled Oil Fields Co. in connection with prospecting for new oil-fields. Realising the possibilities of aerial survey, they approached the Bermuda and West Atlantic Aviation Co., Ltd., with a view to sending out an aerial expedition to survey the delta of the Orinoco River in Venezuela, with the result that two supermarine flying boats were ordered for the job.

These two machines have been completed and passed through their acceptance flights a fortnight ago, and are now on their way across the Atlantic (*via* rail and ship). They are of the standard Mark 2 Channel type "Puma" machine, with the fore part of their hull altered and re-designed to take special camera gear. Arrangements have been made for the instantaneous raising and lowering of the camera and a special device for the fastening of the camera opening by a manhole cover with a kind of breach block action. Abaft this forward compartment, which is occupied by the photographer, is a complete watertight bulkhead which in case of accidents, renders the machine seaworthy.

Special plate racks, insulated from vibration, have also been fitted to the machine.

We believe the expedition takes place over ground which has not yet been explored by white men, and should, therefore, prove both interesting and exciting to the crew—which, by the way, will comprise well-known oil-experts and skilled photographers, in addition to the pilots.

It is estimated that the survey will be completed in 4-6 weeks, which, undertaken by the old methods, would run into a number of years, and might even be impossible.



The Supermarine oil-prospector: This view shows the special camera-manhole in the bottom of the hull near the bows.

One of the two Supermarine flying boats which are being sent on an oil-prospecting expedition to South America.

This, it may be mentioned, is another pioneer movement undertaken with Supermarine machines, they having obtained the first Air and Seaworthiness Certificate from the British Air Ministry; opened up the first commercial flying boat service in the British Empire, and the first international flying boat service from Southampton to Le Havre. For the credit of British aircraft, we wish this expedition every success.

NOTICES TO AIRMEN

Aerodromes for Civil Use: Amendments

NOTICE to Airmen No. 1 of 1921 (Aerodromes for Civil Use: Consolidated List) is amended as follows:—LIST C., *Licensed Civil Aerodromes.*

(*b*) *Civil Aerodromes licensed as "suitable for Avro 504 K and similar types of aircraft only."*

The following should be added:—Stretford (2 fields adjoining Junction): Nearest railway station, Stretford Junction, adjoining Cheshire Lines. Sale, Brooklands Farm: Nearest railway station, Brooklands, ½ mile Cheshire Lines.

The following should be deleted:—Blythe Bridge, Longton; Knutsford, Tabley Lane; Northenden and Wellingborough.

(No. 27 of 1921.)

Pilots' Licences: Compulsory Examination in Navigation

THE technical examination in navigation, referred to in Notice to Airmen No. 13 of the year 1921, will not be brought into operation as from April 1, 1921, as stated therein, but from a date to be notified later when the Convention relating to International Air Navigation has been ratified.

In addition to the syllabus attached to the above-mentioned Notice to Airmen, every applicant for a pilot's licence to fly passenger or goods aircraft (Class B Licence), or for a renewal of such licence, will be required to undergo an examination in elementary meteorology. The syllabus of this examination will be published shortly.

(No. 28 of 1921.)

Canada Prohibits "Stunting"

"STUNTING" other than when flying solo, has recently been forbidden under the Canadian Air Regulations upon the recommendation of the Chairman of the Air Board. It is held that "there is no purpose in 'stunting' in civil flying, and that its prohibition would be beneficial not only for the purpose of preventing accidents but also for the purpose of inducing a realisation that civil flying does not involve or require the taking of risks."

The Air Regulations, 1920, are therefore amended as follows:—

(*a*) No pilot of any flying machine shall unless he is alone therein permit or cause such flying machine to spin, roll, loop or execute any other evolution involving unnecessary risk.

(*b*) It shall be a defence to any prosecution under section 4, sub-section 2, of the Air Board Act for a breach of the foregoing regulation if the pilot establishes that the dangerous evolution was performed without intention on his part and notwithstanding the exercise by him of reasonable care.

AIRISMS FROM THE FOUR WINDS.

LAST year from time to time we referred to the theory of Mr. Solomon J. Solomon, regarding the camouflaging indulged in by the Germans during the War upon an extensive scale for the concealment of large bodies of troops upon the eve of some big movement, these camouflaged areas being detectable by means of photographs from the air, by reason of the photographs disclosing facts at variance with nature. Mr. Solomon's facts appeared to be unassailable, and he now gives corroboration of his theories in the form of a letter from Mr. A. Gordon Macleod, which appeared a few months ago in the *Irish Times*, in which the writer states :—"It may interest your readers to know that in at least one instance the Germans on their retreat neglected to destroy camouflage which they had erected for the concealment of massed bodies of troops and material. On the sector of our advance covered by the 6th Corps large areas covered with this camouflage were left intact by the enemy, notably in the neighbourhood of Mory and Vaulx-Vraucourt (south of Arras). The camouflage consisted of a sort of extensive tenting of wide-mesh wire netting raised about 8 ft. from the ground, the meshes being interwoven with strips of greenish and biscuit-coloured paper-cloth exactly harmonising with the dried-up vegetation of those desolated areas."

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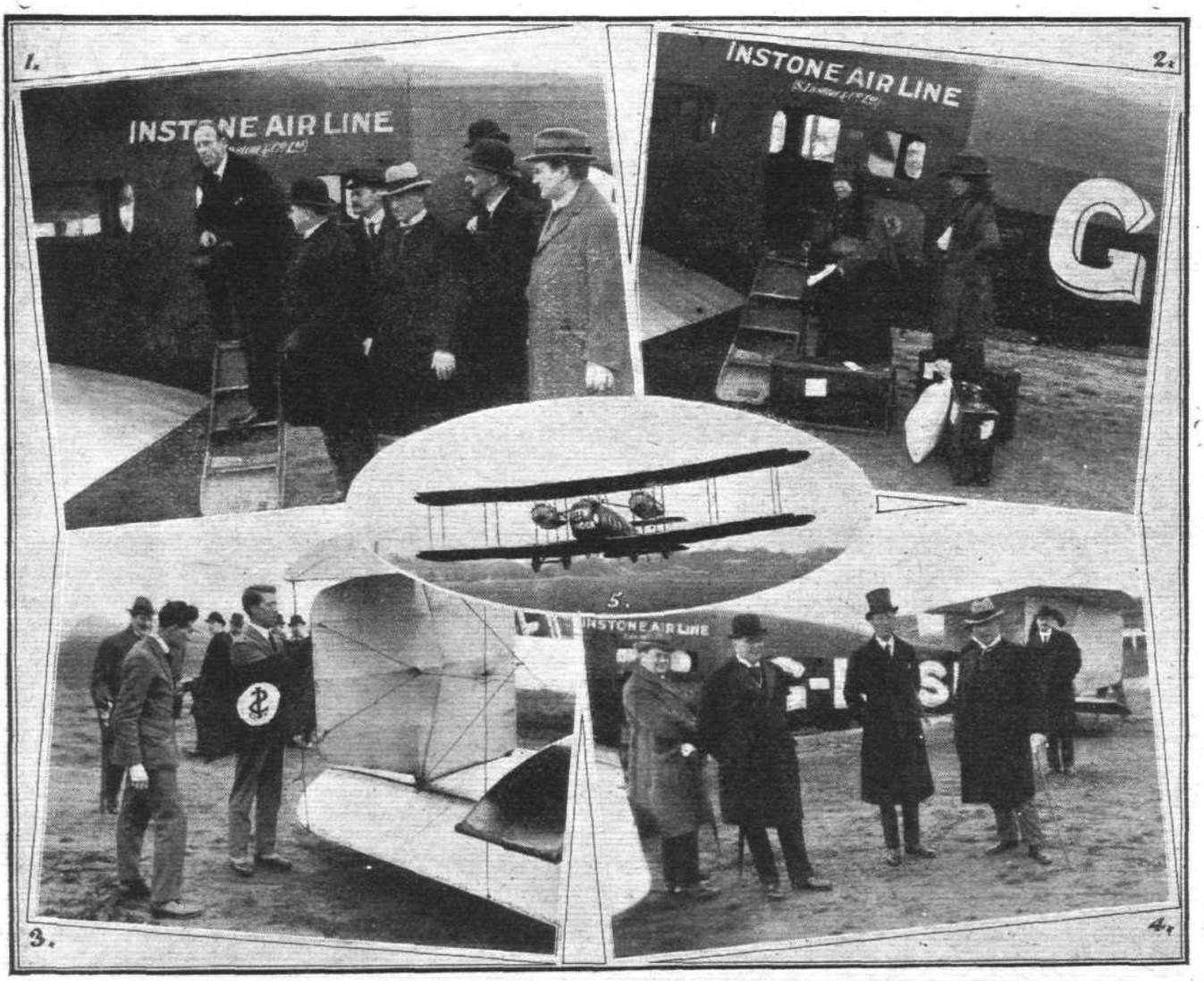
MR. SOLOMON rightly claims this as "a confirmation of the original contention, that the Germans were concealing large bodies of troops under covered-in areas. I could not have guessed this, but saw it in the photographs, and tested the finds by every law known to the painter. And once having confirmed it and the principles on which this camouflage was designed, could not fail to recognise it again anywhere, and more particularly as in this instance an adaptation of my own fishing net was the medium of concealment.

"With an adequate organisation of the search for any kind of artificial covering, which it was now known would be used,



LONDON–PARIS SERVICE RESUMED : AT WADDON AERODROME : The re-starting from this aerodrome on March 21 of the cross-Channel service. (1) Lord Londonderry, after inspecting Messrs. Instone's Vickers-Vimy-Rolls machine ; (2) Passengers embarking with luggage. On left Mrs. Alec Rae, wearing medals for nursing in France, and, right, Mrs. Barnard. (3) The pilot, Mr. Barnard, whose 352nd cross-Channel trip it was, fixes a new flag on his 'bus. (4) In centre, Lord Londonderry, Under-Secretary of State for Air, who attended the restarting of the service ; on left, Mr. S. Instone, and on right, Mr. T. Instone, whose firm are responsible for this particular service. (5) The 'bus taking off for Paris.

we could not have failed to detect at least a large number of the very spots under which Ludendorff was to crowd 10,000 to 12,000 men in every hundred yards square before dawn on March 21. And as we are assured that the day of attack was known, it may be left to the imagination of the reader whether a gun trained on any such registered areas would not have turned what was a disaster for us into a surprising check for the Germans."

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FROM an old member of our Staff we have received the following note :—

"On May 1, in this year of grace, 1921, the Rocky Mountain Aviation Transport Company, Ltd., of Banff and Alta, Canada, will commence flying operation, passenger carrying, etc., weather permitting, with their Norman Thompson N.T. 2B, 210 h.p. 3-seater flying boat—your humble servant at the helm.

"Since settling out here, or rather in B.C., in the summer of 1919, I have kept in touch as much as possible with the progress of flying in Canada, and of all the various companies operating, I have seen none that entered into business with the same possibilities in every single respect as the Rocky Mountain, etc.

"We have a wonderful location on Lake Minnewanka, or Devil's Lake, just out of Banff, and an alternative base at the Vermilion Lakes, even nearer to the town. According to Government statistics, anywhere from 60,000 to 120,000 moneyed tourists visit Banff every season, and there is no doubt that the view of the mountains from 'upstairs' will be one of *the* attractions of the place."

SOME of those "upstair" views may be available for reproduction in FLIGHT, so our readers from afar off may get an idea of the Rockies.

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The following from a "popular" weekly is a gem of the gemmest gem, and we believe this sort of thing wins prizes. So it should! Here it is :—

PLANTING SEEDS FROM 'PLANES.—An airman has invented an aerial grain sower. It is an aeroplane which will sow grain as it passes over a field, planting a row 36 ft. wide at each passage.

A system of perforated metal tubes, laid parallel at short intervals, extends from front to back of the lower wings. Air pressure shoots the seed from the tubes with sufficient force to bury it at the right depth in loose soil. At the end of each wing-tip a tube sends down a thin line of lime to mark the planted area.

Flying at 40 miles an hour, 640 acres can be planted in six hours. To plant the same acreage in the ordinary way a farmer would have to work 22½ 10-hour days. Or to do the job in one day 38 men would have to work together.

The cost of teams for such wholesale sowing, and of the wear and tear on 38 drills, would be a very big item compared with the 9 gallons of petrol an hour consumed by the aeroplane. Moreover, one aeroplane grain-sower could serve a whole district.

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PHEW! Next, please.

A 1921 Paris Aero Salon

IT has now been decided by the Executive Committee of the "Chambre Syndicale des Industries Aeronautiques" to hold an International Aero Show at the Paris Grand Palais next November.

F.A.I. Enlarges Its Membership

THE Aero Clubs of Chili and China have been admitted temporarily to the F.A.I.

France to Honour Air Travellers

FROM Paris it is reported that the French Aero Club has decided to award annually a special medal to a certain number of air travellers having the greatest air mileage to their credit. Professional aviators will be excluded. It is hoped that this award will help to encourage travel by air.

The Dutch–Paris–London Service

APRIL 11 is the starting date by the Royal Dutch Aerial Transport Company's service with Fokker machines over the Amsterdam–Brussells–Paris route, and April 14 for the Amsterdam–Rotterdam–London and the Rotterdam–Hamburg–Copenhagen services.

A Double "Guardian Angel" Parachute Descent

AT Nantes in France, on March 22, Major Orde Lees gave a double parachute display with "Guardian Angel" apparatus. Using two of these when he left the aeroplane he jumped with one of them from a height of 1,500 feet. When about 1,000 feet from the ground he cut himself free and began a new fall with the other, which opened after a drop of only 100 feet. Major Lees landed in the topmost branches of a tree.

A New Morane-Saulnier Monoplane

WE learn that M. Saulnier has just completed the designs for a large cantilever monoplane which is to have seating accommodation for 16 passengers, and will be driven by three Lorraine-Dietrich engines, of which two will be placed in the leading edge of the wings, the third in the nose of the *fuselage*. The monoplane wing will have a span of 88 ft. 6 in. and the wing area will be 1,250 sq. ft. The weight empty has been estimated at 4,300 kilograms (9,450 lbs.) and the weight "all on" at 7,000 kilos. (15,400 lbs.). It is estimated that the machine will take off with two engines only, and fly at 1,500 ft. on one engine.

Lisbon to Madeira by Air

THREE Portuguese naval airmen are reported as having flown last week from Lisbon to Madeira, a distance of 700 miles in 5 hours 32 mins.

Another Air-Acrobat Comes to Grief

FROM Berlin it is announced that an acrobat named Ronaldo, who was performing tricks on an aeroplane in full flight at the Johannisthal aerodrome, had a bad accident. The acrobat had been standing on his head and walking on his hands on one of the wings of the aeroplane at an altitude of about 200 yards, when suddenly the machine crashed to the ground. The crowd rushed to the spot to find that the machine had been destroyed. Ronaldo lay under the wreckage. He had jumped off as the machine was descending, but had been caught by one of the wings, and was found to have broken an arm and several ribs.

Joking with Deeficulty

FROM New York a report states a judgment has been given against a defendant who failed to pay an aerial taxi bill. The case came before Judge John R. Davies in the New York Municipal Court, C. A. Lomas being the defendant. It was stated that Lomas, not believing it possible to hire an aerial taxi, on August 4 last ordered one "just for a joke." The machine was in response sent to the Pier at Eighty-fourth Street and North River, but Lomas did not put in an appearance. A verdict for 25 dollars and costs was given against him, the court holding that an aeroplane taxi service is no more of a joke than motor service taxis on the ground.

There seems to be reason in this, as according to a recent professor the latter costs in New York about the same as an aerial taxi jaunt does in London!

A Parachute World's-Record Claimed

LIEUT. ARTHUR HAMILTON, of the U.S. Air Service, is reported from New York as having left an aeroplane by parachute at a height of 24,400 ft., and a claim is made for this as a world's record. He drifted 8 miles before touching ground, and is said to have fallen asleep from cold during his descent.

British Pioneer Goes Abroad

ON Thursday of last week Lieut.-Col. J. L. Travers left for Chile where he is taking up the post as Aeronautical Advisor to the Chilean Air Service. Col. Travers was among the very early aviators in this country, being down at Eastchurch about 1910, where he built a very curious monoplane with an equally original direct injection engine. Later he joined Messrs. Short Brothers as designer, and was among those who acted as instructors under the early territorial scheme. Then, when that was dropped, Col. Travers was seen at Hendon, where he was contemporaneous with such pilots as Lewis Turner. Before the outbreak of war Col. Travers joined the Royal Naval Air Service. During the War he was largely responsible for the experimental development of seaplanes. In 1916, Col. Travers was appointed to the command of the testing at the Isle of Grain, which post he held until 1918. On leaving Grain, Col. Travers was posted to the Technical Department at the Air Ministry, and until recently he was at the Department of Information, which post he relinquished to take up his appointment in Chile. His many friends will wish him the very best of success in his new position, and hope to see him build up an extensive Chilean Air Service with British seaplanes.

FLYING BOAT CONSTRUCTION

By DAVID NICOLSON, A.M.I.N.A., A.F.R.Ae.S.

(*Continued from page 215.*)

Construction—Type "F"

THE construction of the "F" type is on the box-girder principle, with four *longerons* running right fore and aft. The keel, another fore and aft member, runs from the stern post right round the nose to form the stem and finishes at the gun-ring. The keel and keelson combined with the floors form the backbone of the hull. I am of the opinion that the keel is of faulty design, for many boats were found to leak badly, partly due to the bad connection between the keel and bottom planking, and partly because the keel is too narrow. The keel and planking are fastened with only one row of brass screws which secure the bottom planking to the keel in the hulls of the F.3 type. Another weak point is the discontinuity of transverse strength caused by running the timbers down to the keel and stopping them there, no provision really being made to hold the centre girder to the bottom planking or sides of the hull.

When the F.5 was designed, the keel was connected to the keelson by long "U" bolts which ran down the side of the keelson and through the keel as in Fig. "A." In my opinion this design was so unsatisfactory that if it had been fitted to any boats they would not have been in commission very long

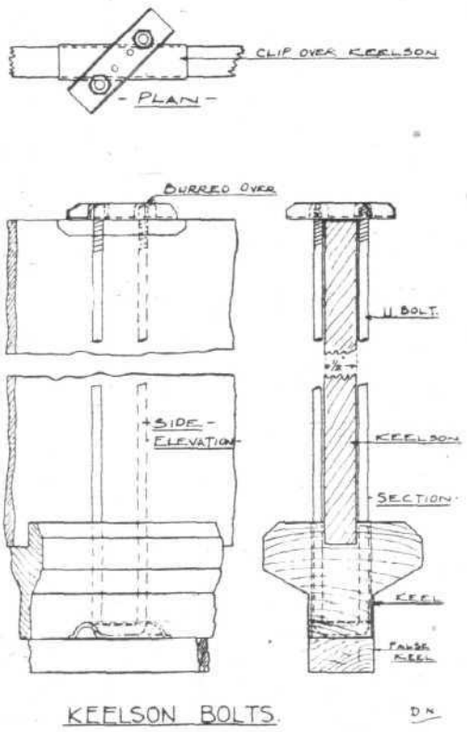

Fig. A.

before they leaked badly. This construction called for very careful workmanship, as only about $\frac{1}{32}$ in. of wood was left between the side of keel and the bolt. Assuming the holes in keel had been bored very carefully and the bolt rammed home, which was securely fastened at the top of keelson by nuts in a small channel, as soon as the boat grounded, or was placed in a trolley, the thin strip of keel between bolt and side would have split, with the result water would have found its way up the side of bolt and into the bilges. Although this construction was so weak and did not lend to quick production, it was with great difficulty I was allowed to modify same to the usual simple boat practice of fastening the keelson to keel by brass screws.

In the F.5 type, the timbers are continuous from fin chine to fin chine, forming a much stronger combination. The keel was increased in depth to $1\frac{3}{16}$ ins., the width being kept the same, namely $2\frac{1}{2}$ ins. It would have been much better if the siding had been increased instead of the moulded depth. The bottom planking is again only fastened with one row of brass screws, which is insufficient. However, a great improvement was made by the continuous timbers as they were through-fastened to the keel by copper rivets.

Keelson.—The keelson is fastened to the keel in the F.3 boats by brass screws 18 ins. apart, but in the F.5 boats the spacing is 9 ins., and the screws are hove up through the bottom of the keel. Although the keelson in some parts measures nearly 12 ins. in depth, it is greatly weakened by having one third of the depth cut out to accommodate the floors.

Floors.—The floors in the F.5 boats have been cut away two-thirds of the depth, thereby sacrificing strength to accommodate the keelson. A built-up floor would have been much more effective, and probably about 40 per cent. lighter.

Timbers.—The timbers are of American rock elm, $\frac{1}{2}$ in. by $\frac{1}{2}$ in., spaced 4 ins. apart amidships, increasing to 7 ins. at the ends of the boat, and terminate at the lower chine; but it would have been an improvement had they been carried to the upper chine. The timbers are through-fastened to the keel by copper rivets.

Fin Top.—The timbers under the fin for the early F.3 hulls were heavy and widely spaced, but the later boat's timbers, $\frac{1}{4}$ in. by $\frac{5}{16}$ in., spaced 2 ins. apart, were substituted to permit all through-fastenings of the diagonal planking on the hard wood timbers. It might also be stated here that the fin top of the first series of F. boats was three-ply birch and in later types was covered with fabric and varnished. The introduction of diagonal planking was a great improvement on this system. All the fins on the F.3 class are flat, but on the F.5 type have $\frac{1}{2}$ in. camber, which adds to the strength, gives a better appearance, and assists in getting rid of water easily.

Stringers.—Two stringers, equally spaced from the fin member, run under the fin, and other two stringers placed immediately below these on the bottom are connected by $\frac{1}{2}$ in. square posts spaced 1 ft. apart. Intermediate stringers, 16 ft. long, are introduced in the fore part of the boat to further strengthen the shell and to absorb shocks when the hull alights on the water.

Fin Member.—In the first boats of the F. type the fin member was of American rock elm. On account of improper connecton between the side of the hull and the fin top, the longitudinal seam naturally opened up, so in later hulls the fin member was constructed with the member and bead in one. This in turn might be improved by rabbeting out a piece at the back to allow the sides to house correctly.

Bow and Nose.—The timbers at the bow are of rock elm $\frac{1}{4}$ in. by $\frac{3}{8}$ in., spaced $2\frac{1}{2}$ ins. apart and are reinforced by horizontal stiffeners, below the top *longerons*. These are spaced to take the outer seams of planking, tapered towards the stem and connected to the same by small oak breasthooks. These breasthooks bend the two sides of the bow together at the juncture of the stringer and stem, thus forming a very strong combination. Above the top *longeron* there are ten deck stringers which are notched to take the ribs, together with three strong beams which subdivide the athwartship ribs. This skeleton, which is shaped like a dome, is planked diagonally, the inner skin being laid at 45 degrees with the forward ends of the planks lowermost. The outer skin is laid approximately fore and aft to suit the curve of nose. Each skin is of mahogany $\frac{3}{32}$ in. thick, the planking being fastened to strong beams with wood screws. Where stringers and ribs occur, copper nails are driven through and fastened on rooves on the outer skin; elsewhere the planks are fastened with copper nails spaced about 1 in. apart.

Sides.—Abaft the bow planking the sides are of three-ply birch and extend from the bottom of the fin member to the top *longeron*, running aft to the gun-port openings, a distance of about 18 ft. The three-ply boards are butted against the side stanchions, thus saving butt straps. In the early F. types, the sides abaft the gun-port openings were built up of a narrow strip of mahogany, which formed a washstrake, with fabric stretched between same and upper *longeron*. The fabric proved not to be strong enough, so this system was superseded by $\frac{1}{16}$ in. diagonal planking with nainsook between the skins. This planking was fastened to timbers running from *longeron* to *longeron*, spaced 2 ins. apart, with one stringer midway running fore and aft. The new tail planking was a great improvement, although it added about 47 lbs. to the weight of the hull; but experience has justified the change and extra cost. Several of the latest hulls have the sides covered with two-ply "consuta" made up of two pieces of very thin mahogany sewn together with flax thread, which is lighter than riveted work.

Bottom Planking.—This is arranged on the diagonal system, the inner skin being of cedar $\frac{1}{8}$ in. thick at the ends and $\frac{3}{16}$ in. thick amidships, fitted at an angle of 45 degrees inclination to the keel. The outer skin is of mahogany $\frac{5}{32}$ in. thick for-

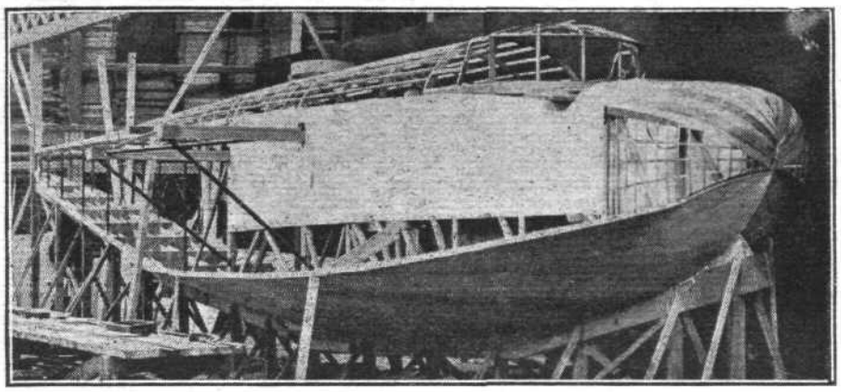

Photo. No. 5.—View showing general construction of F3.

ward, $\frac{3}{16}$ in. thick amidships, and $\frac{1}{8}$ in. thick aft, the planking being at an angle of 30 degrees with the forward end of the planks butting against the keel. This arrangement tends to diminish surface friction in wake of the seams. A layer of varnished fabric is fitted between the two skins making the structure very strong. The planking is fastened together with copper nails, and to the floors and stringers with brass screws. Along the keel and fin member it is connected with brass screws 1½ ins. apart.

In the earlier types of boats, the planking was 5 ins. in breadth with the rivets widely spaced, but it was found that with this breadth the atmosphere affected such thin material and opening of the seams resulted. The planking was afterwards cut down to 3½ ins. in breadth. It was also found necessary to keep the rivets very close to the edge of the planks as there was a tendency for the planks to buckle. The bottom planking extends to the fin chine, which runs from the bow for fully two-thirds of the length of the boat.

Top of Hull.—The transverse strength is made up of beams and arches combined with spruce stringers spaced about 7 ins. apart. The deck aft is built and covered with fabric and the stringers decreased to a minimum in order to keep the tail weight as low as possible.

Bulkheads.—These are four in number, each running from the top of the floors to a few inches above the top of the fin line. They are of $\frac{1}{16}$-in. three-ply birch, stiffened by diagonal spruce stiffeners. The top of the bulkhead is stiffened by a capping piece of spruce. Where a bulkhead is in line with the floor, it is necessary to fit a packing piece between the floor and the bulkhead, except amidships, where the keel is practically horizontal.

Where elevator control wires pass through a bulkhead, a fabric stocking joint with brass washer plates on each side keep the bulkhead watertight, and where centre bracing struts pass through, a three-ply watertight collar is fitted.

Metal Fittings.—The chief elements of the structure, such as struts, pillars, beams, floors, wing root spars, etc., are held and bound together by light steel fittings of about 16 B.W.G.

The metal fittings were so numerous in the F type that they had considerable influence on production, and I am of the opinion that they have been much over-done on these boats, while the opposite is the case on the N boats. It would improve and cheapen the job considerably if a metal fitting were introduced at the ends of stringers and hatches, instead of the wood knees, which are not strong and take up up much time to make and fit.

Bracing.—The *longerons* combined with the struts and stays form the principal superstructure of the hull above the fin top. From the nose to the gun port openings these vertical and diagonal struts are of spruce, moulded to give the greatest strength with lightest section. Abaft the gun-port opening to the stern-post the vertical and horizontal struts are 1 in. mild steel tubes, braced diagonally fore and aft and transversely with 10 B.W.G. wire, all the wires being adjusted by turnbuckles. The tail of the hull is not too stiff in torsion, so adjustment with the bracing wires must be carefully carried out, and all the turnbuckles locked.

Wing Root Spars.—The wing root spars rank among the most important pieces of the structure. They are held in position at the sides and centre of the hull by heavy stanchions and struts. The centre bracing struts are slotted, let over the keelson to which they are bolted, the ends resting on the keel. This may not be considered good practice, as it compels concentration of thrust in a small area, resulting in some cases in springing of the bottom planking and fastenings. Until quite recently all wing root spars were of solid section, grade "A" silver spruce, but these are now laminated in two or three sections.

Outside the hull, and running fore and aft, six ribs of brasswood, all equally spaced from the *longeron* to the end of the spar, further strengthen and help to keep the spars in place. These ribs have two small stringers passing through them giving firmness to the structure, which in turn is covered on top with three-ply birch, and on the bottom a fabric is stretched from the leading edge to the trailing edge, the whole forming the wing roots.

Interior of Hull.—The bottom deck is of sparred spruce boards, varying in width from 3 to 4 ins., screwed to the top of the floors.

About amidships, where the petrol tanks are stored, the floors are shaped to take the tank stools, and are specially stiffened and built up at the sides to form the tank cradles.

Steps.—The steps of the F. 2A and F. 3 boats are framed with ash bearers ½ in. thick, and are 3 ins. deep at the after edge, tapering to meet a board which runs off to a feather edge forward.

The bearers are spaced about 5 ins. apart, and though fastened to the bottom planking, where the timbers come in the way, they also take the fastenings. The bearers are joggled to take the step timbers, which are of ash $\frac{3}{8}$ in. by $\frac{5}{16}$ in., spaced about 2 ins. apart. The inner skin of the planking is of $\frac{3}{16}$ in. cedar, and the outer skin of mahogany of the same thickness, both laid diagonally. The whole step is constructed at the bench, fixed in place, and screwed on to the bearers.

At the forward edge of the steps a 6-in. copper band of light gauge covers the edge of the step, the forward edge of which is sunk into the bottom planking.

Trouble was experienced with the feather boards swelling, and in some cases coming away altogether, due to the "tearing" or frictional resistance of the water when the hulls were driven at great speeds just previous to their getting off. This was remedied in the F.5 boats by carrying the outer skin of the bottom right through from end to end of the boat. The outer skin abaft the back step was then put on and carried forward to a feather edge under the back step, while a short false inner skin was fitted over the usual step framing and then attached to the bottom skin. The outer skin between the steps was put on from the after end of the back step and worked forward to a feather edge under the main step with a false inner skin as before. The outer skin of the fore bottom was then carried right over this from the after side of the main step to the stem. This construction is much stronger and a great improvement on the former step.

Painting.—The inside, as far up as the fin top and the end of the tail, is coated with bitumastic paint, while the remaining portions are varnished. Until recently the bottoms were varnished, and when the final coat was tacky, blacklead was rubbed in and the surface polished. This treatment is as applied on racing yachts, and has proved to be excellent, but as it involved a considerable amount of work at the stations, keeping the bottoms in good condition, it was superseded by black anti-fouling composition. In some cases the anti-fouling composition has not proved very satisfactory, but as far as I am aware this is due to the builders not applying same properly. The paint should be stirred all the time it is being used, and again the boat should be put in the water before the anti-fouling is properly dry.

Another good protection to cover the bottom and fin tops would be velure paint, with a coating of varnish. This would be lighter than the blacklead and varnish, or the composition covering. The outside work not requiring paint is varnished, and should receive at least three good coats, occasionally being rubbed down and revarnished. This is usually neglected with, of course, disastrous results to the material. Two coats of black stove enamel are applied to all the steel fittings. (See Photo. No. 5, General Constructional View of F.3.)

(To be Continued.)

The R.A.F. Colours

IN the cause of accuracy we record the following heraldic description of the Royal Air Force colours :—

Light blue, in the dexter canton the Union, and in the centre of the fly of the flag three roundles superimposed, red upon white upon blue.

THE U.S. BOMBING TESTS

FURTHER details are now to hand regarding the air-bombing etc., scheme which the U.S. authorities have arranged in connection with their own obsolete navy units and the surrendered German craft.

The tests are to take place at sea between June 1 and July 15 and the "fighting" will take place 50 to 100 miles out to sea. There will be the U.S. obsolete battleships *Iowa* and *Kentucky*, and nine former German war vessels. As it is not desired to sink the American ships, dummy bombs only will be used on these by the aeroplanes, but as under a decision by the Council of Ambassadors, the destruction of the German ships is called for between May 1 and August 9 next, these will be sent to the bottom in any case, if no "success" attends either bombing or naval gun practice. The German vessels doomed are the Dreadnought *Ostfriesland*, the light cruiser *Frankfort*, three destroyers and four submarines (U. 111, U. 117, U. 140 and U.B. 148).

The *Iowa* is to be radio-controlled during the tests.

For the German craft 298 bombs are being prepared, comprising 230, 250, 520, 550 and 1,000 pounders or even heavier. If aircraft fail in sinking them, they are to be attacked by battleships, the attacks being made singly and in groups, and after each attack observations are to be made as to effect.

In connection with these experiments, the recommendations submitted to Secretary Daniels by Admiral Coontz as senior member of the joint board, and approved, were in part: Objects sought in tests:

That the bombing experiments contained in the exercises to be conducted by the navy are designed to determine:—

1. The ability of aircraft to locate vessels operating in the coastal zone and to concentrate on such vessels sufficient bombing aeroplanes to make an effective attack.

2. The probability of hitting with bombs from aeroplanes a vessel under way and capable of manœuvring, but incapable of anti-aircraft defence.

3. The damage to vessels of comparatively recent design which will result from hits from bombs of various types and weights.

No report of conclusions as to the probable damage to personnel or equipment or probable or actual damage to the watertight integrity of the target vessel or vessels in general is to be made except by a board in which the navy shall have representation. The results of the experiments and the conclusions drawn are to be held secret by the War and Navy Departments until passed on by the joint board.

In his instructions to Admiral Wilson, Secretary Daniels said: "In preparing this order the department has been guided by the following considerations: Successful naval warfare insures freedom of movement of our own merchant vessels and transports and denies freedom of movement to enemy vessels. Modern fleets will be accompanied by aircraft and vessels will be armed with anti-aircraft batteries. Operations against naval units operating in the coastal zone, from the point of view of the effectiveness of aircraft, divide logically into three phases—the location of such naval units, the ability of the aircraft to hit vessels with their projectiles, the ability of the projectiles seriously to damage a vessel."

AMERICAN AIR TRANSPORT SERVICES

THE following are particulars of air mail and transport services in the U.S. at present said to be in operation or will shortly start:—

Government Owned and Operated Services.—(The United States is the only country in the world to have a government-owned and operated air transport service.)

U.S. Air Mail Service, Post Office Department, Washington, D.C.:—

Routes:—(1) Washington–New York (218 miles). Daily, except Sundays.

(2) New York–Cleveland–Chicago–Omaha–Cheyenne–Salt Lake–Reno–San Francisco (2,266 miles). Daily, except Sundays.

(3) St. Paul–Chicago–St. Louis (610 miles). Daily, except Sundays.

Machines employed.—Forty D.H.-4M (400 h.p. Liberty). Mail load, 400 lb.

Twenty twin D.H. (two 200 h.p. Liberty). Mail load, 600 lb.

Seventeen Curtiss R–4–LM (400 h.p. Liberty). 400 lbs.
Seven Curtiss J.N.–4H (150 h.p. Wright). 200 lbs.
Seven Curtiss-Standard J–1 (150 h.p. Wright). 200 lbs.
Five Junkers, J.L.6 (240 h.p. B.M.W.). 1,000 lbs.
Three G.L. Martin (two 400 h.p. Liberty). 1,500 lbs.
Two Curtiss H.A. (400 h.p. Liberty). 800 lbs.
One L.W.F. (240 h.p. Isotta-Fraschini). 600 lbs.

(Delivery of twelve D.H.-4M and 49 L.W.F. mail airplanes is pending.)

Privately Owned and Operated Services

Aeromarine West Indies Airways, Inc., New York:—

Route: Key West–Havana (106 miles). Daily, except Sundays.

Machines.—Six F.–5–L (two 350 h.p. Liberty) cabin flying boats. Mail load 500 lb. Passenger capacity, 11. Carry U.S. Mails.

Hubbard Air Transport Company, Seattle, Wash:—

Route:—Seattle–Victoria, B.C. (84 miles). Ten trips per month.

Machines.—Boeing seaplanes and flying boats. Carry U.S. mails.

Aero Limited, New York:—

Route:—Miami–Bimini–Nassau, B.W.I. (200 miles). Irregular.

Machines.—F.–5–L (two 350 h.p. Liberty) and H.S.–2L (350 h.p. Liberty) flying boats. Passenger capacity, twelve and six respectively.

America Trans-Oceanic Company, New York.:—

Route.—Miami–Birmini–Nassau, B.W.I. (200 miles). Irregular.

Machines.—Curtiss H.–16 (two 350 h.p. Liberty), H.S.–2L (350 h.p. Liberty), Curtiss Seagull (150 h.p. Curtiss), and Curtiss M.F. (90 h.p. Curtiss) flying boats.

Lawson Airline Company, Chicago:—

This company is under contract with the U.S. Post Office Department to carry mails on a daily schedule on the following routes:—

(1) New York–Harrisburg–Pittsburgh–Fort Wayne–Chicago (735 miles).

(2) Pittsburgh–Columbus–Cincinnati–Indianapolis–St. Louis (600 miles).

(3) New York–Washington–Raleigh–Columbia–Atlanta (815 miles).

A fleet of three-engined cabin airplanes having a mail capacity of 1,500 lb. and accommodation for 16 passengers is under construction. Service on route 1 is to start next spring.

Mercury Aviation Company, Hollywood, Cal.:—

This Company, which for the last year has been operating irregular air transport services in southern California, proposes to establish in the spring a regular passenger air line between Los Angeles and San Francisco (340 miles).

A Zepp. Shed Collapses

WHILST being demolished on March 14 in Jüteborg, near Berlin, a Zeppelin shed suddenly collapsed, a number of workmen being engulfed in the ruins. Five men were killed and about 15 others badly injured.

Rainmaking per Aeroplane

IT surely *must* come, sooner or later, having regard to the many attempts in different directions to solve the problem. The latest is that the U.S. Government is taking a hand in this rainmaking business. Experiments are being conducted by the air service under the War Department which, according to a correspondent of the *New York Mail*, prove that precipitation can be brought about by electrostatic influences, with an aeroplane serving as the medium to persuade clouds to release their moisture. Showers have already been precipitated in secret experiments, and experiments on a large scale are to be conducted this month. According to the state of the weather this side during February, these recent experiments should be a good test of the efficacy—or otherwise—of the methods adopted.

FLIGHT
AIRSHIPS AIRCRAFT ENGINEERING AIRSPACE

THE ROYAL AIR FORCE

London Gazette, March 4

Flying Branch

Transfd to Unemployed List.—Sec. Lieut (Hon. Lieut). A. M. Barron; Jan. 17, 1919. Sec. Lieut. W. H. Smith; Jan. 29, 1919. Sec. Lieut. T. G. Hughes; May 19, 1919.

Administrative Branch

Lieut. (actg. Capt.) A. McC. Wilson relinquishes his temp. commn. on appointment to T.F., and is permitted to retain the rank of Capt. Sec. Lieut. H. Pender relinquishes his temp. comma. on return to Army duty; Aug. 10, 1918. Lieut. A. Lucking is transferred to the unemployed list; Nov. 4, 1919.

Technical Branch

Lieut. V. P. Turner relinquishes his temp. commn.; Feb. 19, 1919. Capt. D. P. Geddes is transferred to the unemployed list; Nov. 8, 1919 substituted for *Gazette*, Nov. 18, 1919).

London Gazette, March 8

Permanent Commissions

The following are granted permanent commns. with effect from the dates indicated, retaining their present rank and seny. Notifications in *Gazettes* of dates indicated, appointing these officers to short service commns. are cancelled:—

Flight Lieut.—G. W. Robarts, M.C. Oct. 10, 1919; (since promoted.)

Flying Officer.—J. Cottle, D.F.C.; Dec. 12, 1919.

Flying Officer L. J. Pearson resigns his permanent commn., and is permitted to retain the rank of Lieut.; Feb. 6.

Stores Branch

The following are granted permanent comms. n the ranks stated, with effect from June 17, 1920, retaining their present seny.:—

Flight Lieut.—E. J. Sayer, M.C.

Flying Officers.—C. M. Bevan (since promoted); J. Hobbs, E. L. Ridley.

The following are granted permanent commns. as Flying Officers, with effect from Sept. 12, 1919, retaining their present seny., and are transferred to the Stores Branch, with effect from June 17, 1920. Notifications in *Gazette*, Sept. 12, 1919, appointing these officers to short service commns., are cancelled:—G. A. Curtis, W. C. Farley.

Flying Officer J. Freeman-Fowler is granted a permanent commn. in the rank stated, with effect from Sept, 12, 1919, and is transfd. to the Stores Branch for accountant duties, with effect from March 4. *Gazette* of Sept. 12, 1919, appointing him to a short service commn. is cancelled. (The seny. of all officers granted permanent commns. in the Stores Branch for accountant duties is provisional only. The final seny. list of all such officers will be promulgated when the establishment is completed.)

Short Service Commissions

The following are granted short service commns. in the ranks stated, with effect from the dates indicated, retaining their original seny. in the substantive rank last held prior to the grant of this commn. except where otherwise stated:—

Flying Officers (from Flight Lieuts.).—D. Fitz-G. Fitz-Gibbon, D.S.C.; Feb. 28. C. B. Riddle; Feb. 22.

Flying Officers.—F. S. Harricks; Feb. 24. L. H. Ridley; Feb. 25. W. J. Walsh; Feb. 26.

Flying Officers (from Pilot Officers).—C. E. F. Arthur; Feb. 24. E. C. Brown; Feb. 26. W. J. McDonough; Feb. 22. B. Sykes; Feb. 26. G. Thornton-Norris; Feb. 22.

Flying Officers Fitz-Gibbon and Riddle will be placed at the head of the list of Flying Officers, and will retain seny. relative to officers who have been similarly gazetted to short service commns. in a rank lower than their previous substantive rank in accordance with their previous position on the gradation list.

Flying Branch

Sec. Lieut. (Hon. Lieut.) G. McCormack to be Lieut.; Aug. 23, 1918 (since granted permanent commn.). Sec. Lieut. W. Susman to be Lieut.; Sept. 28, 1918 (since relinquished). Pilot Officer E. C. Gordon to be Flying Officer; Aug. 2, 1919 (since demobilised). Capt. D. H. M. Carbery relinquishes his temp. comma. on return to Army duty; Jan. 2. Flying Officer A. E. Evans, D.F.C. (Lieut., E. Surrey R.), relinquishes his temp. commn. on return to Army duty; Feb. 10. Sec. Lieut. (Hon. Capt.) T. M. Wilkes relinquishes his temp. commn. on ceasing to be employed; June 8, 1918. The following relinquish their temp. commns.:—Lieut. J. F. Nunn; Sec. Lieut. J. Y. Round.

Lieut. W. Susman relinquishes his temp. commn. on account of ill-health caused by wounds, and is permitted to retain his rank; April 16, 1919 (substituted for *Gazette*, April 15, 1919.)

Transferred to the unempld. list:—Sec. Lieut. J. Evans; Feb. 2, 1919. Sec. Lieut. (Hon. Lieut.) S. Smith; March 21, 1919. Sec. Lieut. G. J. Gaynor; May 2, 1919. Lieut. G. S. Scott; May 14, 1919 (substituted for *Gazette*, June 3, 1919).

The Christian names of Sec. Lieut. William Carlton Woods are as now described, and not as *Gazette*, Oct. 7, 1919. The names of Lieut. Oliver Henry Douglas Vickers are as now described, and not as *Gazette*, July 29, 1919.

Administrative Branch

Lieut. W. R. Gillespie is transfd. to the unempld. list; Dec. 9, 1919.

Technical Branch

Maj. D. A. B. Morle is granted a temp. commn. as Sqdn. Ldr. whilst re-empld.; June 15, 1920 (substituted for *Gazette*, June 18, 1920). Flight Lieut. A. Richard (Lieut.-Cmdr., R.N.) to be Hon. Sqdn. Ldr.; Dec. 30, 1920. Lieut. N. A. Ayres to be Lieut., Grade A, from Admin.; Nov. 1, 1918 (substituted for *Gazette*, Nov. 22, 1918). Sec. Lieut. G. Johnson is transfd. to the unempld. list; Jan. 25, 1919. Lieut. S. J. Edwards, D.S.M., is placed on the retired list March 10.

London Gazette, March 11

Flying Branch

Sec. Lieut. (Hon. Capt.) Lord R. W. E. Grimthorpe to be Lieut.; Nov. 6, 1918 (since demobilised). Sec. Lieut. (Hon. Lieut.) F. V. Le Pavoux, M.C., to be Lieut.; Nov. 10, 1918 (since relinquished). Sec. Lieut. H. H. Purkis relinquishes his temporary commn. Lieut. G. L. Hobbs, M.C., is transferred to the unemployed list; Sept. 22, 1919.

Administrative Branch.

Sec. Lieut. S. H. Scott relinquishes his temp. commn. on ceasing to be emply.; May 4, 1918. Lieut. J. B. Sumner relinquishes his temp. commn. on account of ill-health contracted on active service, and is permitted to retain his rank; March 5.

Technical Branch

Lieut. F. Dawkins (R.E.), is granted a temp. commn. as Lieut., Grade A; Aug. 12, 1918 (since deceased). Lieut. R. T. Smith is transferred to the unemployed list; March 31, 1920.

Dental Branch.—Capt. W. Inman is transferred to the unemployed list; Feb. 15.

London Gazette, March 15

Permanent Commissions

Flight Lieut. R. S. Sorley, D.S.C., is granted perm. commn. as a Flying Offr.; Nov. 27, 1919. *Gazette*, Nov. 28, 1919, appointing this Offr. to a short service commn. is cancelled. Flying Offr. C. B. S. Spackman, D.F.C., is granted perm. commn., retaining his present substantive rank and seny.; Oct. 24, 1919. *Gazette*, Oct. 24, 1919, appointing this Offr. to a short service commn., is cancelled. Flight Lieut. G. J. C. Maxwell, M.C., D.F.C., A.F.C., resigns his perm. commn., and granted rank of Maj.; Feb. 14. Wing Comdr. L. A. Strange, D.S.O., M.C., D.F.C., relinquishes his perm. commn. on acct. of ill-health contracted in Service, and is permitted to retain rank of Lieut.-Col.; Feb. 24.

Stores Branch

Flying Offr. H. J. Barnham is granted a perm. commn., retaining his present substantive rank and seny.; June 17, 1920. Pilot Offr. F. D. D. Gaussen is granted a perm. commn. as Flying Offr., with effect from and with seny. of March 15.

The follg. are granted permanent commns. as Flight Lieuts. for Accountant duties: C. H. Moore, R. Whyte; March 5.

Medical Branch

The follg. are granted permanent commns. as Flight Lieuts., retaining their present seny. (subject to acceptance of final conditions of service). *Gazette* July 13, appointing these offrs. to short service commns., is cancelled:—E. N. H. Gray, D.P.H., R. E. Bell, M.B., E. A. Lumley, M.C., M.B., D. G. Boddie, M.B., H. McW. Daniel, M.B., A. E. Barr-Sim, M.B.; July 13, 1920.

Flight Lieut. D. McLaren, M.B., is granted a permanent commn., retaining his present substantive rank and seny. (subject to acceptance of final conditions of service); March 31, 1920. *Gazette*, Sept. 14, 1920, appointing this offr. to a short service commn., is cancelled.

Short Service Commissions

The follg. are granted short service commns., with effect from the dates indicated, retaining their present substantive rank and seny., except where otherwise stated:—

Flying Offr. (from Sqdn. Ldr.).—C. D. Fuller; March 7.

Flying Offr. (from Flight Lieut.).—E. H. Bryant; March 1.

Flying Offr.—H. L. Christie; March 1. *Gazette*, June 15, 1920, appointing Flight Lieut. B. J. W. Brady, D.S.M., to a short service commn., is cancelled.

Stores Branch

The follg. are granted short service commns. in the ranks stated for Accountant duties:—

Flight Lieut.—A. W. P. Phillips, O.B.E.; March 5.

Flying Offrs.—P. Hay, M.C., G. N. Simon, J. Sullivan, W. R. Westcombe; March 5.

Flying Branch

The follg. Lieuts. relinquish their temp. commns. on appointment to T.F. Reserve, and are permitted to retain their rank:—H. S. Redpath, J. A. Cairns.

Maj. W. H. D. Ackland, M.C., A.F.C., relinquishes his temp. commn. Sec. Lieut. (Hon. Lieut.) H. D'E. Rolland relinquishes his temp. commn., and is premitted to retain the rank of Lieut.; Jan. 27, 1919.

Transferred to the Unemployed List.—Sec. Lieut. (Hon. Lieut.) W. Spencer; April 16, 1919 (substituted for *Gazette*, July 18, 1919). Sec. Lieut. A. H. Miller; June 17, 1919.

Gazettes of dates indicated, relating to the undermentioned officers, are cancelled:—Sec. Lieut. E. G. Brigg; July 2, 1918. Lieut. J. J. Tates; July 30, 1918. Sec. Lieut. A. H. Miller; Sept. 9, 1919.

Administrative Branch

Lieut. T. F. Legard relinquishes his temp. commn., and is granted the rank of Capt.; April 6, 1919. Sec. Lieut. J. S. G. Tassie relinquishes his temp. commn. on ceasing to be employed; Sept. 27, 1918. Lieut. J. A. Elliott is transfd. to the Unemployed List; Jan. 1, 1920 (substituted for *Gazette*, Jan. 13, 1920).

Technical Branch

Sec. Lieut. (Hon. Lieut.) L. Miller to be Lieut., without pay and allowances; April 2, 1918 (since demobilised). Sec. Lieut. (Hon. Capt.) E. F. Ambler relinquishes his temp. commn. Sec. Lieut. A. F. Wilson is transfd. to the Unemployed List; April 22, 1919.

Medical Branch

Capt. (actg. Maj.) G. Cranstoun is transfd. to the Unemployed List; Jan. 14.

Dental Branch

Capt. F. B. Stradling is transfd. to the Unemployed List; March 1.

Stores Branch

The follg. are granted temp. commns. in the rank stated for Accountant duties:—Flying Offrs.: F. W. Arthurton, J. R. Bond, H. J. Cooper, O. K. Griffin, J. S. Griffiths, C. G. Prior, C. W. Rogers, W. A. Wadley, F. H. Wakeford. Pilot Offr.: C. W. Rugg; March 5.

Memoranda

174074 Overseas Cadet E. N. Mitchell is granted a temp. commn. as Sec. Lieut.; Feb. 15, 1919. Sec. Lieut. E. N. Mitchell relinquishes his temp. commn., and is permitted to retain his rank; June 29, 1919. Lieut.-Col. J. D. Mackworth, C.B.E., relinquishes his temp. commn. on account of ill-health contracted on active service, and is granted the rank of Col.; Oct. 24, 1919 (substituted for *Gazette*, Nov. 18, 1919).

Seven Cadets are granted hon. commns. as Sec. Lieuts., with effect from the date of their demobilisation.

Officers apptd. to commns. in a rank lower than their previous substantive rank will be placed at the head of the list of officers of the rank to which they are gazetted, and will retain seniority relative to officers who have been similarly gazetted to commns. in accordance with their previous position on the gradation list.

The seniority of all officers granted commns. in the Stores Branch of Accountant duties is provisionally only. The final seniority list of all such officers will be promulagted when the establishment is completed.

London Gazette, March 18

Permanent Commissions

Flying Offr. H. E. Walker, M.C., D.F.C., is placed on half-pay, Scale B, for six months (from Feb. 20).

Flying Branch

Transferred to the Unemployed List.—Sec. Lieut. (Hon. Capt.) F. T. Gummer; Jan. 31, 1919. Lieut. H. Hargraves; Sept. 8, 1919. Lieut. E. C. Gordon; Sept. 18, 1919 (substituted for *Gazette*, Oct. 19, 1920).

Administrative Branch

The following relinquish their temp. commns. on appt. to T.F., and are permitted to retain their ranks.—Lieut. C. W. Wilson, Sec. Lieut. W. A. Marshman. Sec. Lieut. B. W. N. Still relinquishes his temp. commn. on return to Army duty; May 4, 1918 (substituted for *Gazette*, Feb. 25). Capt. R. G. Wilson is transfd. to the Unemployed List; May 5, 1919. The initials of Lieut. J. P. Scott are as now described, and not as *Gazette*, Aug. 30, 1918.

Technical Branch

Pilot Offr. C. W. Booth to be Flying Offr.; Oct. 1, 1919. Sec. Lieut. R. S. Davey to be actg. Capt., Grade A, while so employed, from April 29, 1919, to April 30, 1919, inclusive, and is graded for pay and allces. as Capt., Grade A., from May 1, 1919, to Dec. 15, 1919, inclusive. Sec. Lieut. P. C. Jones to be actg. Lieut., Grade A, while so empld., from Dec. 29, 1918, to March 9, 1919, inclusive.

Transferred to Unemployed List.—Sec. Lieut. R. B. Stewart; May 23, 1919. Lieut. E. H. Trump; July 3, 1919. Sec. Lieut. F. J. Nicholson; Sept. 26, 1919.

Gazette, Nov. 11, 1919, relating to Flying Offr. F. H. Davis, is cancelled.

Memoranda

Lieut. J. Hobbs is transfd. from S.O. to the Unemployed List; March 1. Capt. J. F. Myles relinquishes his temp. commn. on appt. to T.F., and is permitted to retain his rank.

One Overseas Cadet is granted a temp. commn. as Sec. Lieut.; Feb. 15, 1919.

Sec. Lieut. L. P. MacDonald relinquishes his commn., and is permitted to retain his rank; July 13, 1919.

Five Cadets are granted hon. commns. as Sec. Lieuts., with effect from date of their demobilisation.

London Gazette, March 22

Permanent Commissions

Wing Cdr. C. E. Risk, D.S.O., is placed on half-pay Scale A; March 21. Flying Offr. C. Walker is placed on half-pay, Scale B, from March 2 to March 7, both dates inclusive.

Stores Branch

The following are granted permanent commns. as Flying Offrs., retaining their present rank and sen.:—D. Barron, L. H. Hillier; June 17, 1920.

Medical Branch

Flt. Lieut. F. J. Murphy, M.B., is granted a permanent commn., retaining his present rank and sen. (subject to acceptance of final conditions of service) July 13, 1920 (*Gazette* of July 13, 1920, appointing him to a short service commn. is cancelled).

Short Service Commissions

The following are granted short service commns. in the ranks stated, with effect from the dates indicated, retaining their sen. in the substantive rank last held prior to the grant of this commn., except where otherwise stated:—

Flying Officers (from Flt. Lieuts.).—C. B. Bond; March 10. G. F. Lines, M.C.; March 5.

Flying Officers.—J. H. Bentham; March 14. D. MacLaren; March 8. A. M. West; March 14.

Officers appointed to commns. in a rank lower than their previous substantive rank will be placed at the head of the list of officers of the rank to which they are gazetted, and will retain seny. relative to officers who have been similarly gazetted to commns., in accordance with their previous position on the gradation list. Flt. Lieut. A. B. Langridge, employed on law duties, is promoted to the rank of Sqdn. Leader; March 15. Flying Offr. S. D. Carpenter relinquishes his commn. on account of ill-health contracted in the service, and is permitted to retain the rank of Lieut.; March 10.

IN PARLIAMENT

The Navy Estimates and Aircraft

COL. SIR JAMES CRAIG, Parliamentary Secretary to the Admiralty, when introducing the Navy estimates on March 17, said: With regard to naval air development, most hon. Members were present at the statement of the late Secretary for War when he made his speech dealing with this subject. The naval staff working very closely with the air staff, and the lessons of the War are being applied and numerous experiments carried out by both Services, the result of which has been distinct progress, particularly in the design of aircraft carriers. I class this as a very important subject. The critics of the policy of the Government may rest assured that so far as the Navy is concerned, it is watching most carefully all developments in connection with aircraft and taking a permanent part with the Air Force in all the experiments which are carried out.

Next to having an up-to-date and able staff, it is necessary for us to concentrate as much as possible on the scientific side of naval warfare, and so important do we consider scientific work that there we have one of the few increases in our Naval Estimates this year. The close *liaison* maintained between the Naval staff and the technical departments and the Director of Scientific Research has resulted in a scheme of priority for research work which will ensure the most urgent problems receiving the direct and concentrated attention of the scientific staff. By these means it is also ensured that items of research are undertaken only if necessary to the working of the whole scheme, and that they hold a definite and essential place in the chain of Naval development.

There may be some in the House who are captivated by the picturesque appearance of a vessel being bombed from the air that appeared in some of the Press at home, and a copy of which I have from the *New York Herald*. The design shows the "Indiana," well peppered by aircraft, which is practising on purpose to elucidate that problem. I can only point out, as some hon. Members have pointed out already, that that is a problem for experts, and I would only advance this argument, so far as the air is concerned, that the air is much more dangerous to the submarine type than it is to the battleship or cruiser or even smaller surface craft. That is the experience of the War. I was told on good authority, for instance, that the *Goeben*, which struck a mine and which was towed into Gallipoli, was for five days the subject of attack by the aircraft of the Allies, and although they came down to within very low range, and had five days in which to do it, they only managed to strike her twice, and the resultant damage was of a comparatively slight nature.

Lieut.-Col. Moore-Brabazon: What was the date of that?

Gen. Sir Ivor Philipps: And the size of the bombs?

Sir J. Craig: The total weight of the bombs was 15 tons.

Sir Ivor Philipps: What was the weight of the individual bombs

Sir J. Craig: They were 65 to 112 pounds. As I say, this is a matter for experts, but it has to be borne in mind further that the *Goeben* was a stationary target. I have here an extract from the report of a German naval officer who stated to our Committee of Control that the German destroyers on the Flanders coast were frequently bombed by Allied aircraft. Several destroyers were damaged, but not one was sunk by these means. The Germans consulted their records before making the above statement. Consequently, so far as I have been able to learn, the fear of the damage done to any of our capital ships from the air is much less than one might be led to suppose. I am told that, of course, our anti-aircraft preparations are keeping well ahead of the other experiments that are taking place.

Lieut.-Col. Moore-Brabazon said: I appreciate perhaps more closely than most people how intimately wrapped up the Navy is with the Air. Some say that the power of the air is capable of knocking out the battleships. Others maintain that the capital ship of the future is going to be upon one vast aeroplane carrier. I think the thing is too empiric to lay down definite opinions of that type. The powers of aircraft are limited to what they can do. We do ourselves and the things of the air enormous damage by writing about all sorts of impossible things in regard to the warfare of the present day. I want to draw attention to what aircraft can do at the present moment in naval warfare.

They can bomb, drop torpedoes, and scout—not very well, I think, any of the three. While I am on this subject I want to refer to something which was said by the hon. and gallant gentleman in his opening speech which I thought was very unfair to the Air Force, because he drew attention to what happened in the Dardanelles in 1915. He quoted those who reported as clearly saying or showing that the Royal Air Force of that date could not do any damage to the battleships by day. But the hon. and gallant gentleman must remember the enormous development that took place in aircraft during the War, and to compare the aircraft of today with that of 1915 is perfectly ridiculous. The only things that could be sent down by an aeroplane in those days of 1915 were tiny little bombs that did as much damage as an orange. It was very different three years later. I should like to see the hon. and gallant gentleman putting out our airships now for a few days and seeing what damage could be done. It would be a very different thing.

To go back to what can be done by aircraft to help the fleet, there are, I say, these three things—bomb-dropping, torpedo-dropping, and scouting. These three functions are at present being carried out by the destroyer. It is along that line that development must take place in the air. We have got to build machines—there are already such in sight, though not visible for the moment, and machines will slowly become bigger—that will go to sea by themselves and cross the Atlantic on the water, or if need be in the air, which will be able to take two or three torpedoes and drop them—if they wish to—and they can carry bombs; and, of course, they can always do the scouting work for their main fleet. The principle that these particular types of machines are going on is to be self-supporting. They are going to be really the flying destroyers of the future, and they have got to look after themselves on the high sea. You may say: "Where does the aircraft carrier come in?" The answer of that is that nothing is going to knock out the flying destroyer but the little hornet—what I call the hornet—that is a very fast tiny type of aeroplane which we found at the end of the War was the only thing that dealt really with the big aircraft. Consequently, the Navy is bound to have, and always must have, ships that will carry small fast aircraft in order to knock out the aircraft which are built to deal with the capital ships.

During the next five years, I think, great changes and great modifications will have to be made; it is scarcely possible to go so much ahead at the present time. Yet we have got to keep in mind the technical side of the Navy. The air is what we should be spending money on today. It is on the technical side that we are going to win out, because, remember, six years ahead is only the expression of our technical knowledge today. We do not see the result of technical knowledge for many years, and the technical side of the Admiralty and Air Ministry is responsible for what is in creation, and will be ready for use in six years' time. The future of the Navy is so wrapt up with the Air Service that they must work together, and therefore I appeal to the Financial Secretary to continue as much as possible to keep these technical men and to co-operate with the Air side.

Lieut.-Com. Kenworthy, during his remarks, asked: Why on earth are we spending £3,300,000 in turning a Dreadnought into a seaplane carrier? Could the hon. gentleman let me know whether a more suitable vessel, an ex-German liner, could not be used as a seaplane carrier? Here you have this enormous Dreadnought and you are to spend £3,300,000 on it. You could have built an efficient seaplane carrier for that. It means that she will be a bad compromise; she will have all the disadvantages of an enormous Dreadnought and she can never be a proper seaplane carrier. I hope these constructive suggestions will be considered.

Railway Servants and Air-Raids

CAPTAIN MARTIN on March 22 asked the Minister of Transport if he is aware of the fact that certain employés of some of the great railways have received no recognition of any sort for special services rendered during the air-raid period; and what steps are going to be taken to rectify this omission?

Mr. Neal: The hon. and gallant gentleman will remember that he recently made representations to the Minister of Transport in favour of some extra payment being given to certain grades employed on a particular section of railway who have been required to be on duty during air-raids, and that it was explained to him that this request could not be granted.

Japan (Air Service)

MR. HOGGE, on March 23, asked the Secretary of State for Air if an expedition consisting of 30 former officers of the Royal Air Force is leaving for Japan in order to organise a naval air service; and whether members of this expedition have been sent on courses to Royal Air Force stations in order that they may be conversant with the latest developments of British military and naval aviation?

Capt. Guest: It is understood that a certain number of civilians have been engaged by the Japanese as flying instructors. No mission has been sent by the Royal Air Force. The answer to the last part of the question is in the negative.

Mr. Hogge asked whether British Government aeroplanes and engines are being sent to Japan?

Capt. Guest: The British Government have neither sold nor sent to Japan any aeroplanes or aero engines. It is, however, possible that the Aircraft Disposal Company—in which, as the Secretary of State for Air explained to the House on December 14, 1920, the Government have retained an interest—may have sold certain obsolete or surplus engines to that country.

Surplus Government Aircraft (Disposal)

MR. HOGGE, on March 23, asked the Parliamentary Secretary to the Ministry of Munitions what is the policy concerning the disposal of British aeroplanes and engines to foreign Powers; how many have been sold: and what prices have been obtained?

Mr. Hope: In view of the fact that all surplus Government aircraft was sold by the Disposal Board to a British company under a contract dated March 12, 1920, I am unable to give the information asked for by the hon. member. I may say, however, that sales of aircraft to foreign Powers are governed by International Regulations.

FLIGHT

MODEL AEROPLANES

NOTE.—*All communications should be addressed to the Model Editor. A stamp should be enclosed for a postal reply.*

Some Observations on Stability and What it Means

THE centre of pressure of any wing is the resultant pressure of all the air pressures acting on it. It is well established that the location of the centre of pressure varies with different speeds or air pressures and also at different inclinations to the line of motion. The first thing, therefore, to be decided on is the size of planes required to lift a given weight, and also their shape and curvature (all points which may be fairly easily determined) in consonance with the speed required. Consider now the centre of gravity, and resolve it into its two component forces, upward lift and horizontal motion, the upward lift acting through the centre of pressure. For purposes of experiment fix the plane so that the c.g. is either forward or aft of the c.p. (*see* Fig. 1); in the former position it will dive and in the latter it will stall. This fact is true of either monoplanes or biplanes, unless the centre of pressure of one of the superposed foils is on one side of the vertical line passing through the c.g. and the c.p. of the other plane

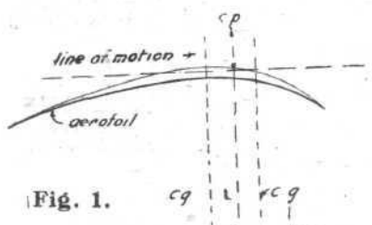

Fig. 1.

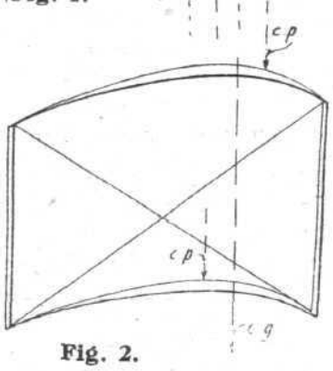

Fig. 2.

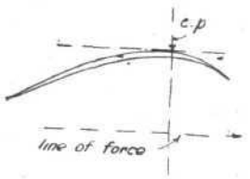

Fig. 3.

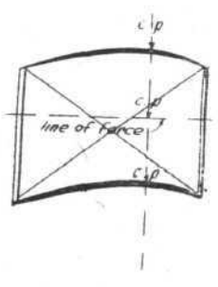

Fig. 4.

is on the other side, in which case the instability of one is neutralised by what may be termed the inverse instability of the other (*see* Fig. 2).

It has been stated that the c.p. changes, and in order for the machine to remain stable the position of the c.g. must be made to move in synchronism with it. Now take into consideration the line along which the force acts; this line must be through the c.p. of the whole machine. To prove this, place it below (*see* Fig. 3), and it will be found that thrust forms a couple with the drift and the machine tends to stall; place it above and the machine tends to dive. At high speeds, owing to increase of drag, this instablilty is very pronounced, whilst at low speeds it renders tuning-up difficult (if the loading is light, almost impossible). It is therefore regarded as proved that the line of force or thrust must act through the c.p.

Now, as the c.p. moves with various pressures and angles of incidence, the line of force should move as near as possible to the locus of the c.p. In a biplane it should be disposed along the resultant c.p. of the two planes (Fig. 4).

If twin screws are used the resultant line of force should pass through the resultant c.p.

Now, since the motive power has to move the weight of the machine, which may be taken as at the c.g., it is obvious that the thrust would be best applied at this spot.

Since, therefore, it is best to have the thrust at the c.g., although it has been previously proved that it must also pass through the c.p., for a machine to be stable the line of thrust must pass through the centre of pressure *and* the centre of gravity of the machine.

A Mechanical Paradox

TWENTY-SIX readers sent in solutions to the mechanical paradox, but not one gave a correct analysis of the phenomenon, which is as follows:—

Taking the general formula $e = \frac{n-a}{m-a}$, we have in the case of the stationary wheel, $m = 0$; in the case of the wheel with 61 teeth, $e = \frac{60}{61}$ and is less than unity.

$$\therefore \frac{n-a}{-a} = \frac{60}{61}$$

$$\therefore 61n - 61a = -60a.$$

Whence $n = \frac{a}{61}$ and is positive.

For the planetary wheel with 60 teeth, $e = \frac{60}{60} = 1$

$$\therefore n - a = -a, \text{ or } n = 0.$$

For the wheel with 59 teeth, $e = \frac{60}{59}$, which is greater than unity.

$$\therefore \frac{n-a}{-a} = \frac{60}{59}$$

$$\therefore 59n = -60a + 59a.$$

Whence $n = \frac{a}{59}$ and is negative.

Only one reader saw that it is really theoretically impossible to cut 60 teeth, 59 teeth and 61 teeth, all of the same pitch on blanks of the same diameter, although it is practicably possible to do so by either altering the pressure angle of the tooth or cutting thick and thin teeth in the 59- and 61-tooth gear. Some readers went out of their way to show me that it wouldn't do it really—only on paper. To this may I state that I have a working model in my possession which I am prepared to lend to any sceptic. After careful checking, I consider the solution sent in by Mr. Cecil D. Holland, 12, Fordwych Road, Cricklewood, N.W.2, to be the clearest and most succinct, and the book is awarded to him accordingly. The following readers sent in meritorious solutions: J. W. Jones, 8, Oxberry Avenue, S.W.6; B. Chandler, 62, Regent Street, Kingswood, Bristol; and D. F. Anderson, Ovoca, Farnborough, Kent.

Replies to Correspondents

D. F. A. (Farnborough) and R. S. (Dublin).—I replied direct.

A. S. H. (Halifax).—Many thanks for the photos. Please let me have larger and clearer ones of the model when completed.

C. F. (Gossnorgh).—An idler is not a ne'er-do-wheel!

Rates on the Berlin–Brunswick–Dortmund Service

FARES per passenger (including conveyance by motor-car to and from the aerodrome, Berlin, and the Hapag office):—

Berlin–Dortmund (or *vice versa*), 500 mks. Berlin–Brunswick (or *vice versa*), 300 mks. Brunswick–Dortmund–(or *vice versa*), 300 mks.

Each passenger is allowed 15 kg. luggage free of charge.

Excess 10 marks for every kg. or part of a kg., in so far as there is accommodation.

Air Mail Fees.—In addition to the usual fees for ordinary registered or express mails, the following fees (when possible in air mail stamps) must be paid:—Postcards, 20 pfennigs; letters up to 20 grammes, 20 pfennigs; 50 grammes, 80 pfennigs; 100 grammes, 160 pfennings; 250 grammes, 240 pfennigs; printed matter up to 50 grammes, 80 pfennigs; 100 grammes, 160 pfennigs; 250 grammes, 240 pfennigs; 500 grammes, 480 pfennigs; 1,000 grammes, 960 pfennigs.

Fees, Etc., for Packages.—In Germnay: In addition to the fee for express packages, 10 marks surcharge for every kg. or part of a kg. The packages must be securely fastened and the dimensions must not exceed 60 × 60 × 60 cm. Letters and packages for conveyance by air mail will be accepted at all post offices. Mails between Dortmund, Hoerde, Witten, Hagen and Bochum are conveyed by motor-cycle.

FATAL ACCIDENT TO LIEUT. J. McINTOSH

IT is with the utmost regret we have to record the death, through an aeroplane accident in Australia, of Lieut J. McIntosh, who with Lieut. R. J. Parer, made that exceedingly plucky and sporting flight from England to Australia last year. It appears that Lieut. McIntosh, while making a cross-country flight, accompanied by his mechanic and a passenger, experienced engine trouble near Pithara (300 miles from Perth), and crashed after a nose-dive from about 2,000 ft. The mechanic also was killed, and the passenger injured.

It will be recalled that the flight to Australia was remarkable for the succession of mishaps and delays that occurred from start to finish. Leaving Hounslow on January 8, 1920, in a D.H. 9 (240 h.p. Siddeley-Puma), they were forced by fog to land at Conteville on their way to Paris, and when eventually arriving at the latter place, were delayed three days through a broken petrol pump. Two more days were lost at Lyons through the same trouble, and later when crossing the Gulf of Genoa, they had to turn back owing to running out of oil, flying about 100 miles with a dry engine before a landing ground could be found. On the way to Rome their machine caught fire at a height of 3,000 ft., and it was only by turning off the petrol and sideslipping down that they managed to escape a terrible death. After more delays they reached Cairo on February 21, their flying time from Hounslow to Cairo being 39 hours. From Cairo they flew to Ramleh in Palestine, and thence across the desert to Baghdad. They had to make a forced landing in the Syrian desert, and spent the night under their machine. In the morning they saw a group of Arabs advancing upon them, but succeeded in holding them off with revolver shots, and managed to get away. From Baghdad they flew to Karachi, where they arrived on March 8. Ultimately Rangoon was reached via Delhi and Calcutta, on Easter Day. Continuing from Rangoon they crashed and damaged their machine so badly that it took six weeks to repair it. The journey was continued with a Caproni propeller supplied by the Italian Government Depôt. Again in Batavia they had a mishap which caused further delay. They now had to cross wide stretches of sea between the Dutch islands, and found difficulty in finding their way. However, just as they were running short of petrol, after an eight hours' flight, they sighted land, and landed at Fanny Bay, in the Northern Territory, Australia, on August 1. Port Darwin was reached the next morning. Ultimately Sydney was reached, but between Sydney and Melbourne they again crashed, this time to such good purpose that the machine was completely wrecked. Another machine was lent to them, on which they ultimately reached Melbourne, where they were given a great reception. They were welcomed by Mr. Hughes, the Australian Premier, to whom, it may be remembered, they handed a bottle of whiskey, which they had brought with them from England, and which had survived all the different mishaps. As a token of the appreciation of their plucky flight they were presented with a cheque for £500 each.

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The Imber Bullet-Proof Tank

BEFORE the Inventions Commission on March 21 the self-sealing Imber petrol-tank was the subject of claim, the claimants being Mr. Jack Imber and Mr. E. C. Lacey. This ingenious tank has already been fully dealt with in FLIGHT.

Mr. Imber, stated counsel, joined the Canadian forces on August 5, 1914. He was afterwards attached to Claremont Park, where various devices were tested, and there it was announced that the authorities were badly in need of a fire-proof petrol-tank for aeroplanes, and Mr. Imber solved the problem within a month.

Counsel read reports of tests in which bullets were fired through the tank below the petrol level and no leak occurred, and instructions were issued, he said, that all two-seater machines, with the exception of training machines, should be fitted with the tank.

Inter-Newspaper Golf Competition

MR. GUY L'ESTRANGE, Captain of the London Press Golfing Society, writes us that if sufficient support is forthcoming, the London Press Golfing Society propose to offer a Challenge Shield for annual competition by foursome play between members representing the various newspaper offices, magazines, periodicals, and news agencies in London, including the London offices of provincial journals. Play will be on the lowest handicap of each competitor.

The majority of offices are already represented in the Society, but, for those which are not, the qualification for membership and nomination forms can be obtained from the hon. secretary at 2, Whitefriars Street, Fleet Street, E.C. 4.

The entrance fee will be half-a-crown for each player, with a half-crown sweepstake in addition. The Challenge Shield will be held for one year by the newspaper, etc., whose representatives win it. Any one publication or agency may enter as many couples as desired.

A New German Company

ACCORDING to the German Press, the Internationale Luftschiffahrtgesellschaft (" Ileg ") has recently been established in Dantzig, with a capital of 2 million marks. The founders are Messrs. Lilienthal and Dip-Ing. Dr. Donski. The former is the expert adviser of the Albatros Works.

The " Ileg " is said to possess extensive aircraft workshops and sufficient material for the construction of about 30 aircraft. It is proposed that branches of the company shall be established in all the chief centres in Poland and further East, and that it will obtain a monopoly of forwarding air mail between the free town of Dantzig and Poland. The company aims at starting services over the lines Dantzig-Warsaw-Lemberg and Dantzig-Posen-Cracow, commencing with the carriage of mails and later taking passengers.

⁂ ⁂ ⁂ ⁂

PUBLICATIONS RECEIVED

United States Air Mail Service : Pilots' Directions, New York-San Francisco Route. Post Office Department, Washington, D.C., U.S.A.

Rendiconti dell'Instituto Sperimentale Aeronautico. February 1921. Tipografia del Senato di Gionavvi Bardi, Rome, Italy. Price L. 15.

Technical Note No. 32. *Causes of Cracking of Ignition Cable.* By F. B. Silsbee. National Advisory Committee for Aeronautics, Navy Building, Washington, D.C., U.S.A.

Technical Note No. 44. *On the Resistance of Spheres and Ellipsoids in Wind Tunnels.* By D. P. Riabouchinsky. National Advisory Committee for Aeronautics, Navy Build ing, Washington, D.C., U.S.A.

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AERONAUTICAL PATENT SPECIFICATIONS

Abbreviations : cyl. = cylinder ; I.C. = internal combustion ; m. = motors
The numbers in brackets are those under which the Specifications will be printed and abridged, etc.

APPLIED FOR IN 1919

Published March 31, 1921

26,302. S. YANO and W. HALL. Radial I.C. engines. (159,536.)
26,250. A. AYMA. Rotary I.C. engines. (159,538.)
26,291. L. B. BOOTH and W. S. SMITH. Apparatus for observing angle of elevation of objects. (159,540.)
29,628. C. H. CASPAR. Aircraft. (150,295.)
30,667. BOULTON AND PAUL, LTD., and J. D. NORTH. Fuselages, etc., of aircraft. (159,644.)
31,051. BOULTON AND PAUL, LTD., and J. D. NORTH. Metal ribs for aircraft. (159,663.)
32,470. J. HAMILTON. Device for automatically indicating when aircraft are not flying on an even keel. (159,698.)

APPLIED FOR IN 1920

Published March 31, 1921

10,968. F. GRATZE. Driving mechanism for aeroplanes. (144,616.)
14,766. F. J. HAUMAN. Mufflers for aeroplane engines. (144,271.)
22,214. J. HAW. Aircrfat propellers. (159,800.)

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6 " " ...	15	2	6 " " ...	16	6
12 " " ...	30	4	12 " " ...	33	0

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